H 2 M architects + engineers

PROJECT MANUAL

WHITE PLAINS CITY SCHOOL DISTRICT
5 HOMESIDE LANE
WHITE PLAINS, NEW YORK 10605

HIGH SCHOOL ADDITION
550 NORTH STREET,
WHITE PLAINS, NEW YORK 10604

SED Control #66-22-00-01-0-016-030

Project No: WPSD2203

CONTRACT C - CIVIL AND SITE WORK
CONTRACT G - GENERAL CONSTRUCTION WORK
CONTRACT M - HEATING VENTILATION AND AIR CONDITIONING WORK
CONTRACT P - PLUMBING WORK
CONTRACT E - ELECTRICAL WORK

FINAL BID SET
MARCH 2025

H2M Architects + Engineers
1133 Westchester Avenue, Suite N-210, White Plains, NY 10605
tel 914.358.5623 fax 914.358.5624

www.h2m.com

The work must be code compliant and conform to all applicable regulations, including the New York State Uniform Fire Prevention and Building Code, The Energy Conservation Construction Code of New York State, the Regulations of the Commissioner of Education, the NYSED Manual of Planning Standards, and regulations of all State and Federal agencies with jurisdiction.

Notice is hereby given that **SEALED PROPOSALS** for:

WHITE PLAINS CITY SCHOOL DISTRICT

ADDITON AT WHITE PLAINS HIGH SCHOOL
SED Control No. 66-22-00-01-0-016-030

CONTRACT C- CIVIL AND SITE WORK
CONTRACT G – GENERAL CONSTRUCTION WORK
CONTRACT P – PLUMBING WORK
CONTRACT M – HEATING, VENTILATION, AND AIR CONDITIONING
CONTRACT E – ELECTRICAL WORK

Will be received until **2:00 PM on Wednesday, April 23,2025,** at the White Plains City School District Office main entrance security desk located at 5 Homeside Lane, White Plains, NY 10605. In the event that on this date the White Plains City School District is closed to all students and all staff or has an early dismissal due to weather or any other emergency that closes all schools and offices for all students and all staff prior to 3:00 PM, bids will be due at 11:00 AM on the next day that the school district is open.

Hard copies and electronic bid documents will be available beginning on **Monday, March 24, 2025.**

Complete Digital Sets of Bidding Documents, Plans and Specifications, may be obtained online as a download at the following website: melville.h2mplanroom 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)** for each combined set of documents. Checks or money orders shall be made payable to **White Plains City 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 than 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 melville.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 melville.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, White Plains City School District**", clearly marked on the outside," ADDITON AT WHITE PLAINS HIGH SCHOOL SED Control No. 66-22-00-01-0-016-030. 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 White Plains City 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 "White Plains City School District", in an amount equal to five percent (5%) 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 forty-five (45) days after the formal bid opening.

A pre-bid meeting and walk thru will be scheduled for Tuesday, April 1,2025 at 11;00am at White Plains High School, 550 North Street White Plains, NY 10605. Potential bidders are asked to gather at the Northwest corner of the property, adjacent to North Street. There is a construction fence surrounding the subject property. We will meet at the gate to the construction site. Potential bidders are asked to contact Lidiya Lininska, for any pre-bid walk-thru questions:

Primary Contact
Lidiya Lininska
Staff Designer
H2M architects + engineers
1133 Westchester Avenue, Suite N 210, White Plains, NY 10605
office: (914) 358-5623 | direct: (914) 231-8267
email: llininska@h2m.com

Secondary Contact
Robert Firneis
Senior Project Manager
Triton Construction Company
Field Office- 228 Fisher Ave, White Plains, NY 10606
office (212) 388-5700 | mobile (914) 635-0913
e-mail: rfirneis@tritonconstruction.net

Although the pre-bid meeting and walk-thru are **not** mandatory, it is highly recommended that all potential bidders make arrangements to visit the site.

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

White Plains City School District

5 Homeside Lane

White Plains, NY 10605

BIDS FOR PROJECT

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

White Plains City School District
WHITE PLAINS HIGH SCHOOL ADDITION
White Plains
SED: 66-22-00-01-0-016-030
CONTRACT G - GENERAL CONSTRUCTION WORK
CONTRACT C - CIVIL AND SITE CONSTRUCTION WORK
CONTRACT P - PLUMBING CONSTRUCTION WORK
CONTRACT M - HVAC CONSTRUCTION WORK
CONTRACT E - ELECTRICAL CONSTRUCTION WORK

TIME AND PLACE

The sealed proposals are to be submitted at the:

White Plains City School District
ADMINISTRATION OFFICE
5 Homeside Lane
White Plains, NY 10605

See notice to bidders for all dates and times.

REQUIRED BID SUBMISSIONS

Each bid submission shall consist of three (3) 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 5% 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. Non-collusive form.

c. Hold Harmless Agreement.

d. Certification of Compliance with the Iran Divestment Act or Declaration of Bidder’s Inability to provide Certification of Compliance with the Iran Divestment Act.

e. Sexual Harassment Certification form.

f. Insurance Certification.

g. Contactor's Certification Form: Labor Law 220-i

h. If the bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof. Each bib must be accompanied by the Insurance Certification Form located in the specifications Failure to provide may result in the School District finding the bidder "non-responsive" to the bid documents.

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 School District'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 School District’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 School District 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 School District.

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 prepared by a Certified Public Accountant.

4. Fully completed statement of bidder's qualification.

5. Fully completed list of subcontractors.

After the low bid for each contract is announced, the sealed list of subcontractors submitted by the apparent low bidder shall be opened and the names of the subcontractors announced.

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.

4. A tie-bid is defined as an instance where bids are received from two or more Bidders who are the low responsive Bidders, and their offers are identical. It is the policy of the District to settle the outcome of tie-bids by either drawing a name from a hat or flipping a coin within 24 hours of the bid opening. All affected firms will be notified of the tie, the time and place of the resolution of the tie and shall be invited to witness the outcome. Attendance is not mandatory. The drawing/flip will be held at the District Administration Office. Two impartial witnesses will be provided and shall be present. All attendees will acknowledge the results of the tie-breaker on the bid tabulation sheet. All firms affected by the bids will be notified of the results. The results pursuant to this provision shall be considered final.

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:

Lidiya Lininska
Staff Designer
H2M Architects + Engineers
1133 Westchester Avenue, Suite N210
White Plains, NY 10605
Phone: (914) 231-8268 ext. 2043
E-mail: lliniska@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:

Lidiya Lininska
Staff Designer
H2M Architects + Engineers
1133 Westchester Avenue, Suite N210
White Plains, NY 10605
Phone: (914) 231-8268 ext. 2043
E-mail: lliniska@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 School District, the School 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, 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 successful bidder 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 examine carefully 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 considered by the School District unless the bidder tendering same demonstrates that it is skilled in work of a similar nature to that envisaged in the Contract/Bidding Documents.

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; for the amount stated in the bid proposal.

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 "White Plains City 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 School District 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 therefrom.

CONTRACTOR'S UNDERSTANDING

It is understood and agreed that the bidder 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 the contract intended to be awarded.

No official, officer or agent of the School District is authorized to make any representations as to the materials or workmanship involved or the conditions to be encountered and the bidder agrees that no such statement or the evidence of any documents or plans, not a part of the contract to be awarded, shall constitute any grounds for claim as to conditions encountered. No verbal agreement or conversation with any officer, agent or employee of the School District 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 bidder 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 the School District's operations or any other contractor performing work at the project site.

EQUIVALENTS

A. In the Specifications, one or more kinds, types, brands, or manufacturers or materials listed are regarded as the required standard of quality and are presumed to be equal. The bidder may select one of these items or, if the bidder 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. Bidder 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 School District and the 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 School District with all such additional information and data for this purpose as may be requested. The School District reserves the right to reject any bid if the evidence submitted by, or investigation of such bidder fails to satisfy the School District that such bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

BID WITHDRAWAL

No bids may be withdrawn for a period of 45 days after opening of bids. The School District may request an extension in writing, if necessary, for bidders to hold their bid for an additional 45 days.

SCHOOL DISTRICT RESERVATION OF RIGHTS

The School District reserves the right to waive what it deems to be informalities relating to a specific bid, to waive what it deems to be technical defects, irregularities and omissions relating to a specific bid, to reject any or all bids, to request additional information from any bidder or to re-advertise and invite new bids.

CONTRACTOR'S QUALIFICATION STATEMENT (POST BID)

The apparent low bidder must submit the required pre-award submittal package described below to the School District's Construction Representative within 48 hours after the bids are opened.

Triton Construction Co., Inc.

Attn: Robert Firneis

228 Fisher Ave

White Plains, NY 10606

Phone: (212) 388-5700

Cell: (914) 635-0913

Email: rfirneis@tritonconstruction.net

Submissions must be emailed and must include the Project Name of this contract in the Subject Line of the Pre-Award submission email.

1. Pre-award Submittal Package
    a. Fully execute AIA-A305 Contractors Qualification Statement.
    b. Most recent financial statement by CPA.
    c. References and experience:

(1) List of all past contracts with K-12 Public School Districts.
(2) Provide three (3) references (Name, Title, Phone Number and email) of persons associated with three (3) different projects (public or private sector) of similar scope and size to the one identified in this contract. Additionally, include the names of two major suppliers used for each of these three (3) projects.

2. Workforce and Work Plan - Provide a detailed written Work Plan which shall / demonstrate the contractor's understanding of overall project scope and shall include, but not be limited, to the following:
   a. Sequential listing of specific project activities required to successfully complete the Work of the Contract.
      (1) Include Schedule and list Critical Milestones.
      (2) Include Phasing of the work, if required.
      (3) Include listing of long lead-time items.
      (4) Impact of weather and restricted work periods.
      (5) Signed statement from a company officer that the Project can be completed in the established construction duration listed in the contract documents.
   b. Resumes for the contractor's proposed project site supervisor and staff including qualifications for specialized expertise or any certifications required to perform the Work.
   c. Names of proposed major sub-contractors (more than 15% of the bid amount) and a listing of the related trade work and value.
   d. Any special coordination requirements with other trades or ongoing contracts under separate contract(s).
   e. Any special storage and/ or staging requirements for construction materials required for the work.
   f. Any other special requirements including those noted in the contract documents or known to the contractor / subcontractor(s).

3. Detailed Cost Estimate:
   a. A copy of Detailed Cost Estimate outlined in CSI format for the contract work.

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 unless the time to award has been extended.

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 School District & Architect/Engineer and in accordance with the specifications annexed hereto and the plans referred to therein.

LABOR RATES

Each Bidder awarded a contract 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 Bidders awarded a contract. The School District shall receive such payroll record upon completion of project.

White Plains City School District

Board of Education

5 Homeside Lane

White Plains, NY 10

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 as well as the following Statement of Bidder's Qualifications.:

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;

(ii) 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 a 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.

e. Documentation evidencing the bidder's Worker's Compensation Experience Modification.

STATEMENT OF BIDDER'S QUALIFICATIONS

IMPORTANT: BIDDERS ARE REQUIRED TO FURNISH A COMPLETE ANSWER TO ALL OF THE QUESTIONS IN THIS STATEMENT. IF ADDITIONAL SPACE IS REQUIRED TO FURNISH A COMPLETE ANSWER, BIDDER MAY ATTACH PAGES AS NECESSARY. IN THE EVENT THAT COMPLETE ANSWERS ARE NOT PROVIDED TO EVERY QUESTION, THE BID WILL BE REJECTED.

1. Name of Bidder

_____

2. Type of Business Entity (e.g., sole proprietor, partnership, corporation, LLC, etc.)

_____

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 the other companies and the individuals who owned, operated, or have been shareholders:

_____

_____

_____

_____

_____

7. 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.

_____

_____

_____

_____

_____

8. 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).

_____

_____

_____

_____

9. 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.

_____

_____

_____

_____

_____

10. 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.

_____

_____

_____

_____

_____

11. 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.

_____

_____

_____

_____

_____

12. 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.

_____

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13. 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.

_____

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_____

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_____

14. Has the bidder, its officers, directors, owner and/or managerial employees been convicted of a crime or been the subject of a criminal indictment? 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.

_____

_____

_____

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_____

15. 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.

_____

_____

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_____

16. 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 #16 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED

_____

_____

_____

_____

_____

17. 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 #17 WITH ITS BID. IN THE EVENT THE LIST REQUESTED IS NOT SUBMITTED WITH THE BIDDER'S BID, THE BID WILL BE REJECTED.

_____

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18. Have the bidder and its bond surety ever been notified by a project Owner that the Owner is contemplating declaring a default and requested a conference to discuss the performance of the contract? If the answer to this question is yes, list the projects on which such a conference was held, and the result of the conference, and the status of the project in question.

_____

_____

_____

_____

_____

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.

_____

_____

_____

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_____

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.

_____

_____

_____

21. Bidder's Worker's Compensation Experience Modifier: _____

Dated: By: _____
(Signature)

_____
(Print Name and Title)

Sworn to before me this

_____day of_____ , 20_____

_____
Notary Public

Contract G - General Construction Work
Contract C - Civil and Site Construction Work
Contract P - Plumbing Construction Work
Contract M - HVAC Construction Work
Contract E - Electrical Construction Work

To: **White Plains City School District**
5 Homeside Lane
White Plains, NY 10605

For the furnishing and installing of materials for all work included under contract as follows:

Made this _____ day of _____, 20_____

_____

_____

_____

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:

END OF SECTION

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 C – Civil and Site Work

ITEM 1 – BONDS and INSURANCES

(written in words) _____($)

ITEM 2 – MOBILIZATION

(written in words) _____($)

ITEM 3– DIVISION 1 – GENERAL REQUIREMENTS

(written in words) _____($)

ITEM 4 – DIVISION 1 – PROJECT SUPERVISION

(written in words) _____($)

ITEM 5 – DIVISION 2 – DEMOLITION WORK

(written in words) _____($)

ITEM 6 – DIVISION 3 – CONCRETE

(written in words)_____($)

ITEM 7 – DIVISION 4 – MASONRY

(written in words) _____($)

ITEM 8 – DIVISION 5 – METALS

(written in words) _____($)

ITEM 9 – DIVISION 7 – THERMAL AND MOISTURE PROTECTION

(written in words) _____($)

ITEM 10 – DIVISION 10 – SPECIALTIES

(written in words) _____($)

ITEM 11– DIVISION 31 – SITE WORK

(written in words) _____($)

ITEM 12– DIVISION 32 – EXTERIOR IMPROVEMENTS

(written in words) _____($)

ITEM 13– DIVISION 33 – UTILITIES

(written in words) _____($)

ITEM 14 – DEMOBILIZATION

(written in words) _____($)

ITEM 15 – AS-BUILT DRAWINGS

(written in words) _____($)

ITEM 16 – PROJECT CLOSEOUT

(written in words) _____($)

ALLOWANCE C1 – ALLOWANCE FOR GENERAL CONTINGENCY

(written in words) *Fifty-five Thousand Dollars and Zero Cents* ($55,000.00)

TOTAL BASE BID (ITEMS 1 – 16 INCLUSIVE, PLUS ALLOWANCE C1)

(written in words) _____ ($)

ALTERNATES

The contractor shall clearly state whether cost indicated is to be added to or deducted from the base bid cost. Failure to clearly state same will be grounds for disqualification of the bidder.
All work included under this heading shall be subject to the general conditions of the project. All construction, workmanship and finishes required by the alternates shall be as specified in the applicable sections of the specifications manual.
The undersigned proposes and agrees that should the following alternates be accepted and included in the contract, the amount of the TOTAL BASE BID will be revised as follows. The undersigned further agrees that should the following Alternates be accepted at a subsequent date, after the base bid contract is awarded, due to additional funds provided to the school district through a Smart Schools Bond Act, the alternate bid prices indicated shall be held and honored for a period of one year from the date of contract signing.

NUMBER	DESCRIPTION	COST
ALT-C1 (Deduct)	**Omit all plants including shade trees, ornamental trees, deciduous trees, evergreen shrubs, and perennials. All lawn areas to remain in base bid. This alternate shall include all labor and material.**	**($)**

Note: The WHITE PLAINS CITY SCHOOL DISTRICT is exempt from Federal, New York State and local taxes. TOTAL AMOUNT BID shall be exclusive of all taxes.

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.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS IN ACCORDANCE WITH ARTICLE 6(W) 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

ALL WORK UNDER THIS CONTRACT SHALL BE COMPLETED BETWEEN THE FOLLOWING HOURS, IN ACCORDANCE WITH THE FOLLOWING DATES:

WORK DAYS:	**Monday – Saturday**
WORK HOURS:	**7:00 AM - 8:00 PM**
CONSTRUCTION START DATE:	**Addition June 30, 2025** **Interior Renovation June 29, 2026**
SUBSTANTIAL COMPLETION:	**June 18, 2027** **Interior Renovation August 14, 2026**
FINAL COMPLETION:	**July 17, 2027**

IF NECESSARY, WEEKEND, HOLIDAY AND EVENING WORK SHALL BE PROVIDED TO ENSURE THE COMPLETION DATES LISTED ABOVE, AT THE SOLE COST AND EXPENSE OF THE BIDDER.

FAILURE OF THE CONTRACTOR TO COMPLETE WORK BY THE SPECIFIED TIME SHALL SUBJECT HIM/HER TO LIQUIDATED DAMAGES AS SET FORTH IN ARTICLE 13 OF THE GENERAL CONDITIONS.

THE ARCHITECT/ENGINEER SHALL ACT AS THE RECORD KEEPER OF CONTRACT DAYS; HE WILL BE THE SOLE JUDGE OF DELAYS CAUSED BY WEATHER. ONLY WEATHER DELAYS, AS ADJUDGED BY THE ARCHITECT/ENGINEER, WILL BE CONSIDERED FOR EXTENSIONS OF THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL SUBMIT A BI-WEEKLY REQUEST FOR DELAYS DUE TO WEATHER TO THE ARCHITECT/ENGINEER FOR APPROVAL. NO OTHER DELAY CLAIMS WILL BE ACCEPTED, FOR CREDIT TOWARDS THE PROJECT COMPLETION SCHEDULE, REGARDLESS OF THE SOURCE OF THE DELAY.

FAILURE OF THE CONTRACTOR TO COMPLETE ALL WORK SHOWN AND SPECIFIED IN THE CONTRACT DOCUMENTS, BY ALL OF THE SPECIFIED TIME FRAMES, SHALL SUBJECT THE CONTRACTOR TO LIQUIDATED DAMAGES, AS SET FORTH IN ARTICLE 13 OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, IN THE SUM OF ONE THOUSAND DOLLARS ($1,000.00) PER CALENDAR DAY. SUCH DAMAGES WILL COMMENCE ON THE DAY AFTER THE COMPLETION DATE OR THE DAY AFTER ANY LISTED MILESTONE DATE IN THE NOTICE TO PROCEED.

WITHIN TEN (10) CONSECUTIVE CALENDAR DAYS AFTER THE DATE OF THE NOTICE OF AWARD, THE BIDDER SHALL EXECUTE THE CONTRACT AND FURNISH THE REQUIRED PERFORMANCE BOND, PAYMENT BOND AND INSURANCES.

THE BOARD OF EDUCATION OF THE DISTRICT RESERVES THE RIGHT TO AWARD THIS CONTRACT TO OTHER THAN THE LOW BIDDER IF THE LAW SO PERMITS.

THE UNDERSIGNED HEREBY ACKNOWLEDGES RECEIPT OF THE FOLLOWING ADDENDA (IF ANY):

ADDENDUM NO.	DATED
_____	_____
_____	_____

SPECIFIC DAMAGES WILL BE ASSESSED AND DEDUCTED FROM AMOUNTS OTHERWISE DUE THE CONTRACTOR FOR ADDITIONAL INSPECTION (FIELD) AND CONTRACT ADMINISTRATION (OFFICE) TIME EXPENDED BY THE ARCHITECT/ENGINEER AND/OR OTHER CONSTRUCTION EMPLOYEE(S) HIRED TO ADMINISTER OR OBSERVE THE CONTRACT, SHOULD THE CONTRACTOR COMPLETE THE CONTRACT BEYOND THE CONTRACT COMPLETION PERIOD SPECIFIED ABOVE.

SUCH DEDUCTION SHALL BE IN ACCORDANCE WITH THE ARCHITECT, ENGINEER'S, AND/OR OTHER CONSTRUCTION EMPLOYEE(S) STANDARD HOURLY BILLING RATES IN EFFECT AT THE TIME FOR THE SCHOOL DISTRICT.

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

BIDDER: _____

BIDDER'S ADDRESS: _____

SIGNED BY: _____ TITLE: _____

DATE: _____

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: (___) _____

FEDERAL I.D. NO. OR SOCIAL SECURITY NO.: _____

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 Work

ITEM 1 – BONDS and INSURANCES

(written in words) _____($)

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

(written in words) _____($)

ITEM 3 – DIVISION 1 – PROJECT SUPERVISION

(written in words) _____($)

ITEM 4 – DIVISION 2 – EXISTING CONDITIONS & DEMOLITION WORK

(written in words) _____($)

ITEM 5 – DIVISION 7 – FIRE STOPPING

(written in words) _____($)

ITEM 6 – DIVISION 26 – ELECTRICAL DEMOLITION

(written in words) _____($)

ITEM 7 – DIVISION 26 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

(written in words) _____($)

ITEM 8 – DIVISION 26 – GROUNDING AND BONDING

(written in words) _____($)

ITEM 9 – DIVISION 26 – SUPPORT DEVICES and HANGERS

(written in words) _____($)

ITEM 10 – DIVISION 26 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEM

(written in words) _____($)

ITEM 11 – DIVISION 26 – ELECTRICAL IDENTIFICATION

(written in words) _____($)

ITEM 12 – DIVISION 28 – LOW VOLTAGE TRANSFORMERS

(written in words) _____($)

ITEM 13 – DIVISION 26 –SWITCHBOARD

(written in words) _____($)

ITEM 14 – DIVISION 26 – PANELBOARDS

(written in words) _____($)

ITEM 15 – DIVISION 26 – WIRING DEVICES

(written in words) _____($)

ITEM 16 – DIVISION 26 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

(written in words) _____($)

ITEM 17 – DIVISION 26 – LIGHTING

(written in words) _____($)

ITEM 18 – DIVISION 26 - UTILITY SERVICES

(written in words) _____($)

ITEM 19 – DIVISION 27 – COMMUNICATIONS

(written in words) _____($)

ITEM 20 – DIVISION 28 – FIRE DETECTION AND ALARM

(written in words) _____($)

ITEM 21 – AS-BUILT DRAWINGS

(written in words) _____($)

ITEM 22 – PROJECT CLOSEOUT

(written in words) _____($)

ALLOWANCE E1 – ALLOWANCE FOR GENERAL CONTINGENCY

(written in words) *Seventy-five Thousand Dollars and Zero Cents* (**$75,000.00**)

TOTAL BASE BID (ITEMS 1 –22 INCLUSIVE, PLUS ALLOWANCE E1)

(written in words) _____ ($)

ALTERNATES

The contractor shall clearly state whether cost indicated is to be added to or deducted from the base bid cost. Failure to clearly state same will be grounds for disqualification of the bidder.
All work included under this heading shall be subject to the general conditions of the project. All construction, workmanship and finishes required by the alternates shall be as specified in the applicable sections of the specifications manual.
The undersigned proposes and agrees that should the following alternates be accepted and included in the contract, the amount of the TOTAL BASE BID will be revised as follows. The undersigned further agrees that should the following Alternates be accepted at a subsequent date, after the base bid contract is awarded, due to additional funds provided to the school district through a Smart Schools Bond Act, the alternate bid prices indicated shall be held and honored for a period of one year from the date of contract signing.

NUMBER	DESCRIPTION	COST
ALT-E1 (Deduct)	**Omit pendant mounted lighting in corridors (I C001, I C002, I C004, I C101, I C102, I C103, I C104, I C104A, I C105, I C105A) Contractor to provide and install 2'x2' recessed lighting in corridors @ +/- 10'-0" AFF. Fixtures shall be type F1 or approved equal. Install fixtures 8'-0" apart. This alternate shall include all material and labor for this work. (Coordinate with General contractor per ALT-G2)**	**($)**

Note: The WHITE PLAINS CITY SCHOOL DISTRICT is exempt from Federal, New York State and local taxes. TOTAL AMOUNT BID shall be exclusive of all taxes.

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.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS IN ACCORDANCE WITH ARTICLE 6(W) 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

ALL WORK UNDER THIS CONTRACT SHALL BE COMPLETED BETWEEN THE FOLLOWING HOURS, IN ACCORDANCE WITH THE FOLLOWING DATES:

WORK DAYS:	**Monday – Saturday**
WORK HOURS:	**7:00 AM - 8:00 PM**
CONSTRUCTION START DATE:	**Addition June 30, 2025** **Interior Renovation June 29, 2026**
SUBSTANTIAL COMPLETION:	**June 18, 2027** **Interior Renovation August 14, 2026**
FINAL COMPLETION:	**July 17, 2027**

IF NECESSARY, WEEKEND, HOLIDAY AND EVENING WORK SHALL BE PROVIDED TO ENSURE THE COMPLETION DATES LISTED ABOVE, AT THE SOLE COST AND EXPENSE OF THE BIDDER.

FAILURE OF THE CONTRACTOR TO COMPLETE WORK BY THE SPECIFIED TIME SHALL SUBJECT HIM/HER TO LIQUIDATED DAMAGES AS SET FORTH IN ARTICLE 13 OF THE GENERAL CONDITIONS.

THE ARCHITECT/ENGINEER SHALL ACT AS THE RECORD KEEPER OF CONTRACT DAYS; HE WILL BE THE SOLE JUDGE OF DELAYS CAUSED BY WEATHER. ONLY WEATHER DELAYS, AS ADJUDGED BY THE ARCHITECT/ENGINEER, WILL BE CONSIDERED FOR EXTENSIONS OF THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL SUBMIT A BI-WEEKLY REQUEST FOR DELAYS DUE TO WEATHER TO THE ARCHITECT/ENGINEER FOR APPROVAL. NO OTHER DELAY CLAIMS WILL BE ACCEPTED, FOR CREDIT TOWARDS THE PROJECT COMPLETION SCHEDULE, REGARDLESS OF THE SOURCE OF THE DELAY.

FAILURE OF THE CONTRACTOR TO COMPLETE ALL WORK SHOWN AND SPECIFIED IN THE CONTRACT DOCUMENTS, BY ALL OF THE SPECIFIED TIME FRAMES, SHALL SUBJECT THE CONTRACTOR TO LIQUIDATED DAMAGES, AS SET FORTH IN ARTICLE 13 OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, IN THE SUM OF ONE THOUSAND DOLLARS ($1,000.00) PER CALENDAR DAY. SUCH DAMAGES WILL COMMENCE ON THE DAY AFTER THE COMPLETION DATE OR THE DAY AFTER ANY LISTED MILESTONE DATE IN THE NOTICE TO PROCEED.

WITHIN TEN (10) CONSECUTIVE CALENDAR DAYS AFTER THE DATE OF THE NOTICE OF AWARD, THE BIDDER SHALL EXECUTE THE CONTRACT AND FURNISH THE REQUIRED PERFORMANCE BOND, PAYMENT BOND AND INSURANCES.

THE BOARD OF EDUCATION OF THE DISTRICT RESERVES THE RIGHT TO AWARD THIS CONTRACT TO OTHER THAN THE LOW BIDDER IF THE LAW SO PERMITS.

THE UNDERSIGNED HEREBY ACKNOWLEDGES RECEIPT OF THE FOLLOWING ADDENDA (IF ANY):

ADDENDUM NO.	DATED
_____	_____
_____	_____

SPECIFIC DAMAGES WILL BE ASSESSED AND DEDUCTED FROM AMOUNTS OTHERWISE DUE THE CONTRACTOR FOR ADDITIONAL INSPECTION (FIELD) AND CONTRACT ADMINISTRATION (OFFICE) TIME EXPENDED BY THE ARCHITECT/ENGINEER AND/OR OTHER CONSTRUCTION EMPLOYEE(S) HIRED TO ADMINISTER OR OBSERVE THE CONTRACT, SHOULD THE CONTRACTOR COMPLETE THE CONTRACT BEYOND THE CONTRACT COMPLETION PERIOD SPECIFIED ABOVE.

SUCH DEDUCTION SHALL BE IN ACCORDANCE WITH THE ARCHITECT, ENGINEER'S, AND/OR OTHER CONSTRUCTION EMPLOYEE(S) STANDARD HOURLY BILLING RATES IN EFFECT AT THE TIME FOR THE SCHOOL DISTRICT.

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

BIDDER: _____

BIDDER'S ADDRESS: _____

SIGNED BY: _____ TITLE: _____

DATE: _____

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: (___) _____

FEDERAL I.D. NO. OR SOCIAL SECURITY NO.: _____

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 Work

ITEM 1 – BONDS and INSURANCES

(written in words) _____($)

ITEM 2 – MOBILIZATION

(written in words) _____($)

ITEM 3– DIVISION 1 – GENERAL REQUIREMENTS

(written in words) _____($)

ITEM 4 – DIVISION 1 – PROJECT SUPERVISION

(written in words) _____($)

ITEM 5 – DIVISION 2 – DEMOLITION WORK

(written in words) _____($)

ITEM 6 – DIVISION 3 – CONCRETE

(written in words)_____($)

ITEM 7 – DIVISION 4 – MASONRY

(written in words) _____($)

ITEM 8 – DIVISION 5 – METALS

(written in words) _____($)

ITEM 9 – DIVISION 6 – WOOD, PLASTICS AND COMPOSITES

(written in words) _____($)

ITEM 10 – DIVISION 7 – THERMAL AND MOISTURE PROTECTION

(written in words) _____($)

ITEM 11 – DIVISION 8 - OPENINGS

(written in words) _____($)

ITEM 12 – DIVISION 9 - FINISHES

(written in words) _____($)

ITEM 13 – DIVISION 10 – SPECIALTIES

(written in words) _____ ($)

ITEM 14 – DIVISION 11 – EQUIPMENT

(written in words) _____ ($)

ITEM 15 – DIVISION 12 – FURNISHINGS

(written in words) _____ ($)

ITEM 16 – DIVISION 14 – CONVEYING EQUIPMENT

(written in words) _____ ($)

ITEM 17 – DEMOBILIZATION

(written in words) _____ ($)

ITEM 18 – AS-BUILT DRAWINGS

(written in words) _____ ($)

ITEM 19 – PROJECT CLOSEOUT

(written in words) _____ ($)

ALLOWANCE G1 – ALLOWANCE FOR GENERAL CONTINGENCY

(written in words) *Two Hundred Thousand Dollars and Zero Cents* (*$ 200,000.00*)

TOTAL BASE BID (ITEMS 1 – 19 INCLUSIVE, PLUS ALLOWANCES G1)
(written in words) _____ ($)

ALTERNATES

The contractor shall clearly state whether cost indicated is to be added to or deducted from the base bid cost. Failure to clearly state same will be grounds for disqualification of the bidder.

All work included under this heading shall be subject to the general conditions of the project. All construction, workmanship and finishes required by the alternates shall be as specified in the applicable sections of the specifications manual.
The undersigned proposes and agrees that should the following alternates be accepted and included in the contract, the amount of the TOTAL BASE BID will be revised as follows. The undersigned further agrees that should the following Alternates be accepted at a subsequent date, after the base bid contract is awarded, due to additional funds provided to the school district through a Smart Schools Bond Act, the alternate bid prices indicated shall be held and honored for a period of one year from the date of contract signing.

NUMBER	DESCRIPTION	COST
ALT-G1 (Add)	**Contractor to provide and install new front entry canopy system and associated items where indicated in drawings. This alternate shall include all material and labor for this work.**	**($)**
ALT-G2 (Deduct)	**Omit corridor (I C001, I C002, I C004, I C101, I C102, I C103, I C104, I C104A, I C105, I C105A) ceiling system 4'-0"x4'-0"(ACP-2) and 4'-0"x6'-0"(ACP-3). Contractor to provide and install new 2'-0"x2'-0" ceiling system (ACP-1) @ +/- 10'-0" AF. This alternate shall include all material and labor for this work.**	**($)**
ALT-G3 (Deduct)	**Omit presentation space (I 002) ceiling system (ACP-4). Contractor to provide and install new 2'-0"x2'-0" ceiling system (ACP-1) @ +/- 10'-0" AFF. This alternate shall include all material and labor for this work.**	**($)**
ALT-G4 (Deduct)	**Omit Art Studio 1 (I 110), Art Studio 2 (I 112), Art Studio 3 (I 106), Fashion Design Room (I 108), Metal Work (I 102), and Ceramics (I 104) ceiling system (ACB-2 and ACB-3). Contractor to provide and install eight (8) acoustical panels (ACP-5) installed to underside of roof deck in each room.**	**($)**
ALT-G5 (Add)	**All loose furniture identified on sheets A704, A705, A706 to be purchased by Contractor and coordinated with Districts vendor.**	**($)**
ALT-G6 (Deduct)	**Omit all wall coverings and tack-able surfaces from corridors. Prep walls for spackle and paint only. Rubber base to remain.**	**($)**

Note: The WHITE PLAINS CITY SCHOOL DISTRICT is exempt from Federal, New York State and local taxes. TOTAL AMOUNT BID shall be exclusive of all taxes.

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.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS IN ACCORDANCE WITH ARTICLE 6(W) 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

ALL WORK UNDER THIS CONTRACT SHALL BE COMPLETED BETWEEN THE FOLLOWING HOURS, IN ACCORDANCE WITH THE FOLLOWING DATES:

WORK DAYS:	**Monday – Saturday**
WORK HOURS:	**7:00 AM - 8:00 PM**
CONSTRUCTION START DATE:	**Addition June 30, 2025** **Interior Renovation June 29, 2026**
SUBSTANTIAL COMPLETION:	**June 18, 2027** **Interior Renovation August 14, 2026**
FINAL COMPLETION:	**July 17, 2027**

IF NECESSARY, WEEKEND, HOLIDAY AND EVENING WORK SHALL BE PROVIDED TO ENSURE THE COMPLETION DATES LISTED ABOVE, AT THE SOLE COST AND EXPENSE OF THE BIDDER.

FAILURE OF THE CONTRACTOR TO COMPLETE WORK BY THE SPECIFIED TIME SHALL SUBJECT HIM/HER TO LIQUIDATED DAMAGES AS SET FORTH IN ARTICLE 13 OF THE GENERAL CONDITIONS.

THE ARCHITECT/ENGINEER SHALL ACT AS THE RECORD KEEPER OF CONTRACT DAYS; HE WILL BE THE SOLE JUDGE OF DELAYS CAUSED BY WEATHER. ONLY WEATHER DELAYS, AS ADJUDGED BY THE ARCHITECT/ENGINEER, WILL BE CONSIDERED FOR EXTENSIONS OF THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL SUBMIT A BI-WEEKLY REQUEST FOR DELAYS DUE TO WEATHER TO THE ARCHITECT/ENGINEER FOR APPROVAL. NO OTHER DELAY CLAIMS WILL BE ACCEPTED, FOR CREDIT TOWARDS THE PROJECT COMPLETION SCHEDULE, REGARDLESS OF THE SOURCE OF THE DELAY.

FAILURE OF THE CONTRACTOR TO COMPLETE ALL WORK SHOWN AND SPECIFIED IN THE CONTRACT DOCUMENTS, BY ALL OF THE SPECIFIED TIME FRAMES, SHALL SUBJECT THE CONTRACTOR TO LIQUIDATED DAMAGES, AS SET FORTH IN ARTICLE 13 OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, IN THE SUM OF ONE THOUSAND DOLLARS ($1,000.00) PER CALENDAR DAY. SUCH DAMAGES WILL COMMENCE ON THE DAY AFTER THE COMPLETION DATE OR THE DAY AFTER ANY LISTED MILESTONE DATE IN THE NOTICE TO PROCEED.

WITHIN TEN (10) CONSECUTIVE CALENDAR DAYS AFTER THE DATE OF THE NOTICE OF AWARD, THE BIDDER SHALL EXECUTE THE CONTRACT AND FURNISH THE REQUIRED PERFORMANCE BOND, PAYMENT BOND AND INSURANCES.

THE BOARD OF EDUCATION OF THE DISTRICT RESERVES THE RIGHT TO AWARD THIS CONTRACT TO OTHER THAN THE LOW BIDDER IF THE LAW SO PERMITS.

THE UNDERSIGNED HEREBY ACKNOWLEDGES RECEIPT OF THE FOLLOWING ADDENDA (IF ANY):

ADDENDUM NO.	DATED

SPECIFIC DAMAGES WILL BE ASSESSED AND DEDUCTED FROM AMOUNTS OTHERWISE DUE THE CONTRACTOR FOR ADDITIONAL INSPECTION (FIELD) AND CONTRACT ADMINISTRATION (OFFICE) TIME EXPENDED BY THE ARCHITECT/ENGINEER AND/OR OTHER CONSTRUCTION EMPLOYEE(S) HIRED TO ADMINISTER OR OBSERVE THE CONTRACT, SHOULD THE CONTRACTOR COMPLETE THE CONTRACT BEYOND THE CONTRACT COMPLETION PERIOD SPECIFIED ABOVE.

SUCH DEDUCTION SHALL BE IN ACCORDANCE WITH THE ARCHITECT, ENGINEER'S, AND/OR OTHER CONSTRUCTION EMPLOYEE(S) STANDARD HOURLY BILLING RATES IN EFFECT AT THE TIME FOR THE SCHOOL DISTRICT.

THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

BIDDER: _____

BIDDER'S ADDRESS: _____

SIGNED BY: _____ TITLE: _____

DATE: _____

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: (___) _____

FEDERAL I.D. NO. OR SOCIAL SECURITY NO.: _____

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 M – HVAC Construction Work

ITEM 1 – BONDS and INSURANCES

(written in words) _____ ($)

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

(written in words) _____ ($)

ITEM 3 – DIVISION 1 – PROJECT SUPERVISION

(written in words) _____ ($)

ITEM 4 – DIVISION 2 – EXISTING CONDITIONS & DEMOLITION WORK

(written in words) _____ ($)

ITEM 5 – DIVISION 7 – FIRE STOPPING

(written in words) _____ ($)

ITEM 6 – DIVISION 23 – HW PIPE, VALVES, FITTINGS, PIPE HANGERS AND SUPPORTS

(written in words)_____ ($)

ITEM 7 – REFRIGERANT AND CONDENSATE PIPING AND SUPPORTS

(written in words) _____ ($)

ITEM 8 – DIVISION 23 – MECHANICAL SYSTEM IDENTIFICATION

(written in words)_____ ($)

ITEM 9 – DIVISION 23 – BALANCING OF AIR SYSTEMS

(written in words)_____ ($)

ITEM 10 – DIVISION 23 – PIPING & DUCTWORK INSULATION

(written in words)_____ ($)

ITEM 11 – DIVISION 23 – CONTROLS

(written in words) _____ ($)

ITEM 12 – DIVISION 23 – SHEET METAL WORK

(written in words)_____ ($)

ITEM 13 – DIVISION 23 – DIFFUSERS, REGISTERS AND GRILLES

(written in words) _____ ($)

ITEM 14 – AS-BUILT DRAWINGS

(written in words) _____ ($)

ITEM 15 – PROJECT CLOSEOUT

(written in words) _____ ($)

ALLOWANCE M1 – ALLOWANCE FOR GENERAL CONTINGENCY

(written in words) *Eighty-Five Thousand Dollars and Zero Cents* (**$85,000.00**)

TOTAL BASE BID (ITEMS 1 –15 INCLUSIVE, PLUS ALLOWANCE H1)

(written in words) _____ ($)

ALTERNATES

The contractor shall clearly state whether cost indicated is to be added to or deducted from the base bid cost. Failure to clearly state same will be grounds for disqualification of the bidder.
All work included under this heading shall be subject to the general conditions of the project. All construction, workmanship and finishes required by the alternates shall be as specified in the applicable sections of the specifications manual.
The undersigned proposes and agrees that should the following alternates be accepted and included in the contract, the amount of the TOTAL BASE BID will be revised as follows. The undersigned further agrees that should the following Alternates be accepted at a subsequent date, after the base bid contract is awarded, due to additional funds provided to the school district through a Smart Schools Bond Act, the alternate bid prices indicated shall be held and honored for a period of one year from the date of contract signing.

NUMBER	DESCRIPTION	COST
ALT-M1 (Deduct)	**Omit curved linear diffusers between ceiling panels in presentation space (I C002). Contractor to provide and install new 2'x2' diffusers and associated items. This alternate shall include all material and labor for this work. (Coordinate with General contractor per ALT-G3)**	**($)**
ALT-M2 (Deduct)	**Omit tie-in of back-up fintube heating system and all associated work in the existing boiler room under A-wing in existing building. Contractor shall prep and cap the lines in the A-wing boiler room for the back-up fintube heating system.**	**($)**

Note: The WHITE PLAINS CITY SCHOOL DISTRICT is exempt from Federal, New York State and local taxes. TOTAL AMOUNT BID shall be exclusive of all taxes.

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.

THE BIDDER HAS SUBMITTED ALL REQUESTS FOR OTHER BRAND NAMES OR PRODUCTS NOT LISTED IN THE SPECIFICATIONS IN ACCORDANCE WITH ARTICLE 6(W) OF THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION.

SITE SUPERVISION

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TIME OF COMPLETION

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THE UNDERSIGNED HEREBY ACKNOWLEDGES RECEIPT OF THE FOLLOWING ADDENDA (IF ANY):

ADDENDUM NO.	DATED
_____	_____
_____	_____

SPECIFIC DAMAGES WILL BE ASSESSED AND DEDUCTED FROM AMOUNTS OTHERWISE DUE THE CONTRACTOR FOR ADDITIONAL INSPECTION (FIELD) AND CONTRACT ADMINISTRATION (OFFICE) TIME EXPENDED BY THE ARCHITECT/ENGINEER AND/OR OTHER CONSTRUCTION EMPLOYEE(S) HIRED TO ADMINISTER OR OBSERVE THE CONTRACT, SHOULD THE CONTRACTOR COMPLETE THE CONTRACT BEYOND THE CONTRACT COMPLETION PERIOD SPECIFIED ABOVE.

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BIDDER: _____

BIDDER'S ADDRESS: _____

SIGNED BY: _____ TITLE: _____

DATE: _____

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:

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FAX: (___) _____

FEDERAL I.D. NO. OR SOCIAL SECURITY NO.: _____

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 WORK

ITEM 1 – BONDS and INSURANCES

(written in words) _____($)

ITEM 2 – DIVISION 1 – GENERAL REQUIREMENTS

(written in words) _____($)

ITEM 3 – DIVISION 1 – PROJECT SUPERVISION

(written in words) _____($)

ITEM 4 – DIVISION 22 – PLUMBING DEMOLITION WORK

(written in words)_____ ($)

ITEM 5 – DIVISION 22 – NEW PLUMBING FIXTURES, APPLIANCES, AND CARRIERS

(written in words)_____ ($)

ITEM 6 – DIVISION 22 – NEW GREASE TRAP WORK

(written in words)_____ ($)

ITEM 7 – DIVISION 22 – DOMESTIC BOOSTER PUMP WORK

(written in words)_____ ($)

ITEM 8 – DIVISION 22 – ACID NEUTRALIZATION TANKS

(written in words)_____ ($)

ITEM 9 – DIVISION 22 – BACKFLOW DEVICES AND ALL ASSOICTED VALVES FOR DOMESTIC WATER SYSTEM

(written in words)_____ ($)

ITEM 10 – DIVISION 22 – BACKFLOW DEVICES AND ALL ASSOICTED VALVES FOR FIRE SPRINKLER SYSTEM

(written in words)_____ ($)

ITEM 11 – DIVISION 22 – NEW DOMESTIC WATER HEATER (INCLUDES ALL PIPING AND MATERIALS FOR THE INSTALLATION OF THE WATER HEATER)

(written in words)_____ ($)

ITEM 12 – DIVISION 22- NEW KITCHEN WATER HEATER (INCLUDES ALL PIPING AND MATERIALS FOR THE INSTALLATION OF THE WATER HEATER)

(written in words)_____ ($)

ITEM 13 – DIVISION 22- NEW NATURAL GAS METER RIG, INCLUDING PIPING, VALVES, REGULATORS, METERS, CHAIN LINK FENCE, BOLLARDS, AND CONCRETE PAD

(written in words)_____ ($)

ITEM 14 – DIVISION 22- PLUMBING PIPING, INCLUDING SUPPORTS, HANGERS, HARDWARE, INSULATION, AND FITTINGS.

(written in words)_____ ($)

ITEM 15 – DIVISION 22- NATURAL GAS NEW WORK

(written in words)_____ ($)

ITEM 16 – DIVISION 22- FIRE SPRINKLER WORK, INCLUDING PIPING, SUPPORTS, HANGERS, WET ALARM CHECK VALVES, SPRINKLER HEADS, FLOW AND TAMPER SWITCHES AND HARDWARE.

(written in words)_____ ($)

ITEM 17 – DIVISION 22 – PLUMBING EQUIPMENT

(written in words) _____($)

ITEM 18 – DIVISION 22 – ALL OTHER PLUMBING CONTRACT ITEMS

(written in words)_____ ($)

ITEM 19 – DIVISION 23 – COMMISSIONING

(written in words)_____ ($)

ITEM 20 – DIVISION 32 – WATER SUPPLY SYSTEM

(written in words)_____ ($)

ITEM 21 – AS – BUILT DOCUMENTS

(written in words) _____($)

ITEM 22 – PROJECT CLOSEOUT

(written in words) _____($)

ALLOWANCE P1 – ALLOWANCE FOR GENERAL CONTINGENCY

(written in words) *Forty-Five Thousand Dollars and Zero Cents* (

$45,000.00)

TOTAL BASE BID (ITEMS 1 – 22 INCLUSIVE, PLUS ALLOWANCE P1)
(written in words) _____ ($)

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Interior Renovation June 29, 2026

SUBSTANTIAL COMPLETION: **June 18, 2027**
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THE UNDERSIGNED HEREBY ACKNOWLEDGES RECEIPT OF THE FOLLOWING ADDENDA (IF ANY):

ADDENDUM NO.	DATED
_____	_____
_____	_____

SPECIFIC DAMAGES WILL BE ASSESSED AND DEDUCTED FROM AMOUNTS OTHERWISE DUE THE CONTRACTOR FOR ADDITIONAL INSPECTION (FIELD) AND CONTRACT ADMINISTRATION (OFFICE) TIME EXPENDED BY THE ARCHITECT/ENGINEER AND/OR OTHER CONSTRUCTION EMPLOYEE(S) HIRED TO ADMINISTER OR OBSERVE THE CONTRACT, SHOULD THE CONTRACTOR COMPLETE THE CONTRACT BEYOND THE CONTRACT COMPLETION PERIOD SPECIFIED ABOVE.

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THE REQUIREMENTS OF THE PROPOSAL HAVE BEEN COMPLETELY READ, UNDERSTOOD AND ACKNOWLEDGED BY THE BIDDER.

BIDDER: _____

BIDDER'S ADDRESS: _____

SIGNED BY: _____ TITLE: _____

DATE: _____

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: (___) _____

FEDERAL I.D. NO. OR SOCIAL SECURITY NO.: _____

Enclosed in the bid package is a certified check or bid bond for five percent (5%) 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: _____

_____

INSURANCE CERTIFICATION

Your insurance representative must complete the form below 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 for must accompany your bid submission 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 can provide 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's Signature

Bidder's Acknowledgement:

I acknowledge that 1 leave 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 White Plains City School District may award the contract to the next lowest/responsive bidder.

Name: _____

Address: _____

_____

_____

Date: _____ _____

Bidder's Signature

NON-COLLUSIVE FORM BIDDING CERTIFICATE
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 berequired 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 contractoror by a third party, the contractor covenants and agrees that he / she 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 / her 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 _____

20___

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.

_____

SWORN to before me this SIGNED

_____ day of _____

20___

Notary Public: _____

WHITE PLAINS CITY SCHOOL DISTRICT
WHITE PLAINS HIGH SCHOOL ADDITION

SEXUAL HARASSMENT CERTIFICATION

The following certification must be submitted with all bids submitted after January 1, 2019 pursuant to N.Y. State Finance Law § 139-1(1)(a).

"By submission of this bid/proposal, each Bidder and each person signing on behalf of any Bidder certifies, and in the case of a joint bid each party thereto certifies its own organization, 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."

Dated: _____ _____
(Signature Here)

_____
(Signatory's Name Printed)

_____
(Name of Bidder)

-FORM OF DISCLOSURE-

THE UNDERSIGNED AFFIRMS THAT THE FOLLOWING CONSTITUTE ALL OFFICERS, DIRECTORS, PARTNERS, OR CONTROLLING PRINCIPALS OF THE FIRM:

Name	Title
_____	_____
_____	_____

1. Does any School District Board Member, administrator, or employee possess any financial interest, directly or indirectly, in the firm?_____ If yes, set forth the basis upon which a financial interest exists in the firm:

   _____

   _____

2. Has the firm or any of its officers, directors, partners, or controlling principals possessed any interest in transactions heretofore entered into with the School District?_____ If yes, please describe transaction(s):

   _____

   _____

3. Does any direct relative of a member of the Board, administrators, or staff possess any financial interest, directly or indirectly, in the firm (For purpose of this inquiry a direct relative is to be defined as a parent, spouse, child or sibling)._____If yes, set forth below the School District Board Member, administrator, or staff member whose relation possess an interest and the relationship:

   _____

   _____

THE UNDERSIGNED AFFIRMS THAT THE ABOVE STATEMENTS ARE TRUE AND UNDERSTANDS THAT ANY FALSE STATEMENT SHALL CONSTITUTE A VIOLATION OF THE PENAL CODE OR GENERAL MUNICIPAL LAW AS APPLICABLE.

Firm: _____

Signature: _____

Print Name: _____

Title: _____

Date: _____

CONTRACTOR CERTIFICATION FORM: LABOR LAW § 220-i

SIGN AND SUBMIT WITH BID

Contractors submitting bids for a municipal public work project must be registered with the New York State Department of Labor ("NYSDOL") ***before*** the submission of a bid. The person authorized to submit this bid on behalf of the prospective bidder hereby certifies, under the penalties of perjury, that: **(1)** the prospective bidder (i.e., contractor) is currently registered with the NYSDOL pursuant to NYS Labor Law § 220-i; and **(2)** each and any subcontractors engaged by contractor for work on this project shall be registered with the NYSDOL pursuant to NYS Labor Law § 220-i prior to commencing work on the project. Certificates of Registration for subcontractors can be submitted with this form but ***must*** be submitted ***before*** such subcontractor(s) commence work on the project. Bidder will be responsible for any project delays caused due to a subcontractor's failure to timely register with the NYSDOL. *Failure to complete this form or to include copies of bidder's current Certificate of Registration may result in disqualification from this bid.*

Bidder hereby represents it has attached to this form, a copy of the Certificate(s) of Registration issued by the NYSDOL for the Bidder.

Project: _____

Bidder's Business Name: _____

Bidder's Address: _____

Bidder's NYSDOL Certificate Number: _____

Issued: Expiration Date: _____

Subcontractor(s) NYSDOL Certificate Number (*if available at time of bid submission*): _____

_____

☐ Copy of Bidder's NYSDOL Certificate of Registration is attached. A copy of a submitted application will not be accepted.

Date: _____ _____

Signature of Bidder's Authorized Representative

_____

Sworn to before me this _____ Print Name/Title

day of _____, 20___

_____

Notary Public

SPECIAL PROVISIONS

These Special Provisions are in addition to the Drawings, Specifications and the other Contract Documents and shall be part of the Agreement between the Owner and the Contractor. All references to "This Prime Contractor", "This Contractor" or "Contractor" refer to the **General Contractor, Plumbing Contractor, Mechanical Contractor, Electrical Contractor and Site Contractor**. In cases of contradictions, the most stringent provision shall govern.

General Requirements for Each Prime Contractor

I. General

1. All dates and durations defined herein shall be in business days.
2. Except for the basic building permit, each Prime Contractor's price shall include all fees and other costs for securing and maintaining (by the Prime Contractors or their subcontractors) for the life of the Project; all permits, PE licenses, connection fees, inspections, etc., applicable to, or customarily secured for the Work. This provision includes any applications and/or permits to be issued by utility companies in the name of the Prime Contractor, or the Owner, as required for the Work. Originals of all permits are to be issued in the name of the Prime Contractor as required for the Work. The Prime 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 agreed to with the Construction Manager.
3. One week after Notice of Award (NOA), each Prime Contractor shall provide two 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 Prime Contractor shall be responsible for paying the costs associated with any and all repairs or replacements of existing materials and/ or conditions that were damaged in an area where the Prime Contractor is working or has worked, as may be deemed necessary by the Owner or the Construction Manager.
4. Each Prime Contractor is responsible for providing the required mock-ups defined by the Contract Documents out of sequence as needed by the Architect.
5. Each Prime Contractor is required to schedule Pre-Installation Meeting for various installations, such as but not limited to Rain Screen system, Roofing, etc. prior to the installations. Representatives of the Contractor, their sub-contractor for installation, the manufacturer, Architect, Owner and Construction Manager must be in attendance at the meeting.
6. Each Prime Contractor is responsible for providing all required Engineered material calculations as defined by the Contract Documents.
7. Each Prime Contractor shall provide drinking water for his own employees.
8. <u>On Site Communications.</u> Each Prime Contractor shall provide, or otherwise see that, the project manager, or site managers, and/or responsible workers of each Prime Contractor and major

subcontractor are equipped with cellular phones for the purpose of staying in contact with the Construction Manager.

9. Each Prime Contractor shall include in his base price the cost of all rigging and equipment required for the performance and installation of the Work.
10. Each Prime Contractor shall cooperate with Separate Contractors for the performance of any separate contracts that the White Plains City School District may award.

II. Schedule

1. All Contractors are to recognize that the Project Schedule is of critical importance to the Owner. All aspects of construction must reflect a 'time is of the essence' construction strategy. The attached 'Bid Schedules' serves as a guide of critical milestone dates to the Project. Failure to meet intermediate milestone dates will jeopardize the overall Project Schedule. This failure will mandate Contractor(s) to, increase staff, work overtime, or use other means to recover time, at the costs of those Contractor(s) responsible for such delays. In addition, all costs due to delays in completion of the Work, which require additional Custodial Overtime, Construction Management services, Architectural services, and Engineering services beyond the Work duration in the Bid Schedule, shall be borne by Contractor(s) responsible for delays.

2. Each Contractor, prior to being awarded the contract shall prepare and submit a Preliminary Master Project Schedule for their Work. **Within three (3) weeks of Notice of Award all Prime Contractors will provide a coordinated Draft master schedule**. Each Prime's Project Schedule are to reflect all requirements for submittals, material and equipment procurement, material stockpiling, setting up Contractor's staging area and surveying of existing conditions. These Schedules, reflecting the critical milestone dates established by the **Key Milestone Dates/Construction Schedule**, are to be coordinated and shall be inclusive of other Prime Contractor's activity. The "Final" agreed upon overall schedule of work shall be developed and maintained by the Prime Contractor for General Construction in conjunction with the Construction Manager utilizing each Prime Contractor's Preliminary and updated Schedule(s). Specific relationships between Contractors, sequencing of activities, phasing, and critical "ties" of coordinated Work must be detailed on the Project Schedule. All Contractors shall utilize "Sure Track Project Manager 3.0-" as produced by Primavera Systems, Inc., -or- equal platform producing Gant Style Scheduling.

3. All Prime Contractors shall review the completed "Final" detailed construction schedule and acknowledge their acceptance of this schedule by signing a copy to be kept on record by the Construction Manager. **This agreed upon schedule must incorporate all milestone dates and shall be established within five (5) weeks of Notice of Award.**
4. The Prime Contractor for General Construction shall update the detailed construction schedule with the Construction Manager and issue copies to the other Prime Contractors, the Owner, Construction Manager, and the Architect monthly. Each Prime Contractor shall provide the Prime Contractor for General Construction with all information necessary to provide these updates.
5. Each Prime Contractor is to submit a schedule of projected fabrication on long lead items (items requiring four weeks and over to fabricate) three weeks after Notice of Award. Progress/Status reports

on fabrication to be submitted to the Construction Manager every two weeks. 'Rate of Change' chart and marked up shop drawings to be included in these reports.

6. The Prime Contractors shall be responsible for coordinating and expediting their fabrication and delivery schedules and keeping the Construction Manager informed as to their progress and their anticipated ability to stay on schedule. Should it become necessary (in the opinion of the Construction Manager) to supplement the Prime Contractor's expediting efforts in order to maintain job progress, the Construction Manager may elect to charge all costs incurred to said Prime Contractor.
7. In the event that Owner makes special arrangements to open a building at the request of a Contractor, the Prime Contractor shall pay the Owner all costs incurred. All parties agree that any action taken to enforce this requirement shall not be construed by any Prime Contractor or its subcontractors/suppliers, as a reason for a claim (for either time or money) for delay to the Work or to the Prime Contractor, its subcontractors, or suppliers.
8. The Owner shall take partial occupancy of the building additions and renovated spaces in accordance with the dates established by the Bid Schedule and the Special Provisions. The Contractors shall perform all Work necessary to maintain the Owner's move-in and occupancy schedule.
9. The Contractors shall include in their base price, all out of sequence Work and any Work required to be performed during overtime hours or non-working hours necessary to maintain the Master Schedule, the Prime Contractors' project schedule, and, the Owner's move-in schedule.

Milestone Requirements

Submittal Priorities

The following submittal dates (in calendar days) are critical to allow for proper fabrication timeframes to ensure timely completion of the project to meet the **Key Milestone Dates/Construction Schedule**. A complete listing of all submittal requirements is located in "Section 01300 Submissions", which shall be accompanied by each division's specific submittal requirements.

Major General Construction Submittals

Scaffolding and/or Stair tower-(may require PE Stamp)	15 days from Notice to Proceed
Bracing/Shoring-(may require PE Stamp)	15 days from Notice to Proceed
Foundation Shop Drawings	15 days from Notice to Proceed
Rebar/Reinforcing Shop Drawings	15 days from Notice to Proceed
Structural Steel/Decking	15 days from Notice to Proceed
Masonry Submittals/Shop Drawings	15 days from Notice to Proceed
Stormwater/Sanitary	15 days from Notice to Proceed
Doors/Hardware	15 days from Notice to Proceed
Windows/Openings	15 days from Notice to Proceed
Storefront	15 days from Notice to Proceed
Waterproofing	15 days from Notice to Proceed
Louvers	15 days from Notice to Proceed
Interior Finishes	20 days from Notice to Proceed
Exterior Wall System	20 days from Notice to Proceed
Display Cases/Cabinets/ Equipment	20 days from Notice to Proceed

Casework	20 days from Notice to Proceed
Elevator	20 days from Notice to Proceed
All remaining Submittals with-in	**20 days from Notice to Proceed**

Major Roofing Construction Submittals

Roofing/Tapered Shop Drawings	10 days from Notice to Proceed
Roofing	10 days from Notice to Proceed
Mechanical Curbs	10 days from Notice to Proceed
Misc. Structural Steel	15 days from Notice to Proceed
All remaining Submittal with-in	**20 days from Notice to Proceed**

Major Plumbing Equipment

Plumbing Equipment	15 days from Notice to Proceed
Plumbing Fixtures	15 days from Notice to Proceed
Sprinkler Piping, Accessories, and Equipment	15 days from Notice to Proceed
All remaining Submittals with-in	**20 days from Notice to Proceed**

Major HVAC Equipment

Duct Work	15 days from Notice to Proceed
Equipment	20 days from Notice to Proceed
Controls	20 days from Notice to Proceed
Hot/Chilled Piping and Enclosures	20 days from Notice to Proceed
All remaining Submittals with-in	**20 days from Notice to Proceed**

Major Electrical Equipment

Service Equipment	15 days from Notice to Proceed
Fire Alarm	15 days from Notice to Proceed
Public Address/Intercom	15 days from Notice to Proceed
Security	15 days from Notice to Proceed
Technology	15 days from Notice to Proceed
Light Fixtures	15 days from Notice to Proceed
Site Lighting	20 days from Notice to Proceed
All remaining Submittal with-in	**20 days from Notice to Proceed**

Major Site Construction

Asphalt Pavement and finish surfaces	15 Days after Notice to Proceed
Stormwater/Sanitary	15 days from Notice to Proceed
Concrete curbs and slabs	15 Days after Notice to Proceed
Grass and Soil Data	15 Days after Notice to Proceed
Irrigation Piping and Accessories	15 Days after Notice to Proceed
Site Lighting, unless specified to be provided by EC	20 Days after Notice to Proceed
Fencing	20 Days after Notice to Proceed
All remaining Submittals with-in	**20 days from Notice to Proceed**

Construction Milestones

All Prime Contractors

Special consideration should be made to the requirements of the noted below in the **Key Milestone Dates/Construction Schedule**. Prime Contractors will be required to staff each contract to meet the milestone dates indicated below and/or in the contract bid schedule. All costs should be included in the bid for working multiple shifts, nights, weekends, and holidays to complete each phase of the project.

Time frames indicated show milestone dates required to be met by all Prime Contractors. These areas, once completed, will be punch-listed and given partial occupancy for the Owner to occupy. Occupying these areas is critical to the Owner. If said dates are not met Liquidated Damages may be assessed and back-charged to the responsible Contractor**.**

Key Milestone Dates/Construction Schedule **Bidding and Award of Contracts**

- Bid Period March 24, 2025 - April 30, 2025 @ 10:00am
- Last Day to Submit RFI: Monday, April 21, 2025 @ 1:00pm
- Bid Opening: Wednesday, April 30, 2025 @ 10:00am
  - Ed House 5 Homeside Lane, White Plains, NY 10605
- Bid Qualification Review and Scoping Review Meetings Wednesday April 30, 2025 – Friday, May 9, 2025
- BOE Award Wednesday, May 21, 2025

- Contractor access in schools to perform investigations and measurements
  - After School Hours
  - Holidays / Recess; School Calendar for School Year 2025-2026 will be provided when it is available
    - December Recess; to be provided
    - Winter Recess; to be provided
    - Spring Recess; to be provided

  The Schools may not be open every day when there is a holiday or recess.

- **Last day of Classes** **Friday, June 27, 2025**
  Friday, June 26, 2026

  Last day of classes in June 2026 to be confirmed by the School District when the school calendar is prepared for the school year, 2026-27

- **Abatement**, if any
  - **Between July 1st -July 8th, 2025 and June 30th – July 8th, 2026**
  - **Clearance and Demobilizations by July 8th, 2025 and July 8th, 2026**
- **Construction Start**
  - **Addition** **Monday, June 30, 2025**
  - **Interior work at connection to existing building** **Monday, June 29, 2026**
- **Milestone/Construction Activities Completion Dates (Milestone Dates are in Bold)**
  - **Foundations** **October 10, 2025**
  - **Steel Framing & Decking at Floors & Roof** **November 28, 2025**
  - ***Foundations and Steel Construction at connecting Corridor of Addition to Existing HS Building*** ***Coordinate with HS Schedule when building is unoccupied***

- **Concrete Floor Slabs** — **January 16, 2026**
- **Superstructure Topping Out** — **January 30, 2026**
- **Exterior Walls (Weather Tight)** — **March 27, 2026**
  - **Provide temporary weathertight and secure closures at door & window openings**
- **Roofing (Weather Tight)** — **April 17, 2026**
- **Connecting Corridor from Addition to Existing Building** — **June 26, 2026**
- **Interior Renovations at Existing Building** — **August 14, 2026**
- **Exterior Façade Rain Screen** — **October 23, 2026**
- **MEP Rooftop Equipment** — **November 13, 2026**
- **Permanent Power to Addition** — **December 11, 2026**
- **Elevator** — **April 9, 2027**
- **Equipment Installations (Kitchen….** — **April 16, 2027**
- **MEP Start Ups/CX/Staff Training** — **April 16, 2027 – May 14, 2027**
- **Sitework** — **May 14, 2027**
- **Fire Alarm** — **May 14, 2027**
- **Fire Alarm Testing** — **May 14, 2027 – June 15, 2027**
- **Equipment Connections (Kitchen….** — **May 14, 2027**

- **Construction Substantial Completion All Work** — **June 18, 2027**
- **Final Completion (30 days after Substantial Completion)** — **July 19, 2027**

- **Commissioning of Systems** — **May 14, 2027 – June 15, 2027**
- **SED Inspections**
  - **Preliminary** — **May 14, 2027**
  - **Final** — **June 18, 2027**

SCHOOL OPERATIONS & CONTRACTOR WORK HOURS

This Project will affect many areas, which in some cases will remain in operation during construction. During the school session all contract work not effecting the District's Operation may be performed weekdays between the hours of 7:00 am and 4:00 pm. All contract work effecting the Operation of the School must be performed on an after-hours schedule, weekends or school holidays.

Each Prime Contractor may work Saturday & Sundays to make up for lost time (Saturday/Sunday work will be required if necessary to meet a deadline) with prior approval from the Owner and after Contractor has verified allowable working hours by town ordinance.

Due to extreme traffic congestion associated with student and parent cars and bus transportation, deliveries to any area of the project WILL NOT be allowed during school days from 7:10 a.m. to 7:45 a.m. and 2:00 p.m. to 2:45 p.m.

All Contractors will provide in their base bid (30) thirty "black out days", per each school year, to the construction schedule where no work can take place due to state testing or other school activities requiring no noise and or disruptions from construction activities. These dates will be determined by the District and have been incorporated into the milestone dates indicated in the Key Milestone Dates/Construction Schedule. Blackout dates will only be required for trades with work that will take place during the academic school year (September 1st- July 1st).

III. SAFETY / LOGISTICS/STORAGE

1. Two weeks after the receipt of the Notice of Award, the Prime Contractor for General Construction shall provide a Site Safety/Logistics Plan to the Construction Manager. The site logistics plan should minimally include locations of the eight-foot high temporary fence, traffic plans for deliveries and removals, refuse container locations, crane locations, pick locations, boom radius, and lift locations. This plan shall also show the location of all staging and storage areas, non-rated and fire-rated partitions used to separate construction and school areas, made with plywood and/or gypsum wallboard, etc. The logistical information represented by the Construction Documents shall serve as a minimal guide.
2. Each Prime Contractor is to submit their corporate safety policy and project site specific plan within (2) weeks after Notice of Award. Plan to minimally meet OSHA standards. Each Prime Contractor shall make the participation of their subcontractors in this program mandatory. These Safety Programs should be a detailed Company Policy defining the specifics as to how a safe work environment shall be maintained
3. Each Prime Contractor and Sub Contractors shall schedule weekly safety meetings (Job Site Safety Talks) and submit meeting minutes indicating attendees and topics to the Construction Manager.
4. Each Prime Contractor is to identify in writing to the Construction Manager their "OSHA Competent Person Regarding Safety. "Competent person" means one who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
5. All flagpersons required for deliveries to the site are to be furnished by the Prime Contractor responsible for the delivery. Any and all deliveries crossing the site or student traffic areas shall be escorted by flagpersons. All flagpersons shall wear orange vests. All deliveries shall be scheduled and coordinated with the Construction Manager and the Owner. Delivery blackout periods for bus traffic interference are stated above and from time to time additional blackout periods may be established by the Owner and/or Construction Manager due to school activities or events (e.g. crane operations, etc.).
6. Smoking (including vaping and electronic cigarettes), firearms, controlled substances, THC products, alcoholic beverages, and indecent photography are expressly prohibited on all school properties. All persons representing Contractors, subcontractors or suppliers shall wear shirts, long pants and other proper attire while on school property. All persons representing Contractors, subcontractors or suppliers shall conduct themselves in a professional manner consistent with the rules and policies of the Owner, and the New York State Education Department while on school property or otherwise representing this Project.
7. Each Prime Contractor will ensure that all their employees, while on school property, will wear hard hats, high visibility vests, and ID badges at all times. Anyone on site without this safety gear will be escorted off school property.
8. Each Prime Contractor will ensure that every employee working on this Project has completed a 10-hour OSHA training course. Any worker that cannot present a 10-hour OSHA safety-training card will be escorted off the Owner's property.
9. Food truck vendors are not permitted on Owner property.

10. **Identification Badges**. Each Prime Contractor will provide an ID badge for each of their field personnel and their Sub-Contractor field personnel prior to coming on school property. All workers shall display the badge on their person while on site, and at all times. Failure to wear identification badge at all times will result in the immediate removal from the jobsite.
11. Each Prime Contractor is responsible for their own storage and personnel trailers at each site. Each Contractor will be required to supply man trailers and storage box trailers as required. All costs related to such trailers, including but not limited to delivery, construction, protection, power is borne by the individual Contractors utilizing space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of these trailers will be strictly limited to predetermined locations. Approval of the placement of any trailer or storage box must be received from the Construction Manager.
12. The parking for construction personnel shall be limited to designated parking areas only. Failure to abide by this rule will result in towing of cars at the expense of the Prime Contractor who employs the vehicle owner(s).
13. All delivery vehicles/trucks/machinery/etc. permitted on site, must be equipped with back-up alarms and enter through the designated access points. Failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the Prime Contractor responsible for the delivery involved.
14. All temporary construction site fences installed by any Prime Contractor shall be installed with a tightly woven, blind screen mesh. This mesh is to be installed on the "construction" side of the fence. The General Contractor will maintain all fencing daily and lock gates at the end of the day.
15. All crane picks, material delivery, etc. must be coordinated so as not to lift over any occupied area of the building. This work will be done on off hours to ensure the safety of the building occupants. Crane locations must be carefully chosen to ensure the safety of building occupants. Crane picks must not be conducted during academic hours within 20 feet of an occupied building.
16. The Owner or Construction Manager reserves the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Prime Contractor at its own expense must make corrections before continuing work. The Owner or Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. Each Prime Contractor or Sub Contractor shall cooperate with the inspector by allowing time for the inspection. The Prime Contractor shall be notified 24 hours prior to the time of the inspection. These inspections do not release the Prime Contractors of their responsibility to provide all engineering, permits, and inspections as required by OSHA or the NYSED prior to use of any hoisting equipment.
17. All vehicular traffic (personal vehicles, trucks, equipment, deliveries, etc.) are to use the designated entrances as outlined on the Logistics Drawings. Access by other routes is to be on exception basis only.

IV. SUBMITTALS

1. Each copy of each submittal shall have attached as the cover page the "Submittal Cover Sheet". All information requested in "Section 01 33 00 Submittal Requirements" shall be provided by the respective Contractor. Submittals will be returned without review if the cover sheet is not accurately completed.

2. Each Prime Contractor shall generate a complete "Submittal Log" within one (1) calendar week of the Notice of Award. This log is to list all required submittals specific to your trade as detailed in the Project Manual/Specifications. Include on the Submittal Log "ROJ" stands for Required on Job to assist your judgment of the time gap between submission, Architect review, fabrication/procurement and on-site need for putting the work item into place.

3. Each Prime Contractor shall review all submissions for completeness. Each Prime Contractor is responsible to stamp all shop drawings prior to submission to the Architect. The Architect will not review any shop drawings unless first reviewed by said Contractor. Bundle similar material submissions for proper review. Use the Architects Submittal cover sheet located in the Specifications

4. **All submissions shall be sent electronically to the Architect. Submittals will be processed and stored electronically, with access available to all Prime Contractors for coordination.**

5. Each Prime Contractor shall provide one transmittal for each submission package identifying each unique submission individually. For each submittal within the submission package, the Prime Contractor shall identify the length of the delivery time and the necessary "last date" an item may be received on site. Each Prime Contractor shall keep a log of all submissions in a manner prescribed by the Construction Manager. Minimally, the Contractor shall update this submittal log biweekly and provide a copy to the Construction Manager for review and information.

6. Each Prime Contractor shall copy the Construction Manager's Project Manager on all transmittals, correspondence, RFI's and any other documents sent to the Architect, the Architect's consultants or the Owner.

7. At the direction of the Construction Manager, the Prime Contractor shall provide copies of either document and/or data files for any requested document on one of the following programs: Microsoft Word, Microsoft Excel, or Primavera's SureTrack – Project Manager 2.0 scheduling program.

V. LINE, LEVELS & GRADE

1. The Prime Contractor for General Construction shall establish a baseline and benchmark system for each building addition, area of renovation or component. This survey work shall be completed by a licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall not have less than five years' experience in performing construction surveys similar to the work they will perform for this Project. The other Prime Contractors and their subcontractors shall be responsible for extending these lines, levels and grades, and for performing all layouts for their own work. Each Prime Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level or grades in their layout. Each Prime Contractor and their subcontractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the drawings, perceived by a Prime Contractor or subcontractor, shall be immediately reported to the Construction Manager and Architect. If any corrections are necessary, they shall be executed in accordance with procedures approved by the Construction Manager.

2. Each Prime Contractor and their subcontractors shall be responsible to offset, or to protect, their markings from anything that may disturb them.

3. The Prime General Construction Contractor and all other Contracts will build to existing conditions of the site and adjoining buildings. To confirm line, level and grade, the Prime General Construction Contractor will employ a licensed NYS surveyor by the end of the Project and produce an 'As-Built' drawing including final elevations and boundaries of any structural or earth modifications.

4. In addition to the General Construction Trade, the Site Contractor will be required to hire a NYS Licensed Surveyor to perform existing and finish grade surveys at the new athletic field. The hired surveyor is to follow the same guidelines mentioned in paragraphs 1-3 of this section.

VI. MANAGEMENT OF WORK

1. **Each Prime Contractor shall employ (from one week after Notice of Award until punch-list and closeout are complete) at a minimum a full time Project Manager and full time on Site Super. The Project Manager and Site Super shall represent the Prime Contractor. All communications given to the Project Manager or Site Super either verbal or written shall be as binding as if given to the Prime Contractor. Important communications shall be so confirmed in writing.**
2. Each Prime Contractor shall provide copies of their daily construction reports to the Construction Manager's Field Superintendent. These reports shall be submitted no later than 10:00am the following workday. The daily reports shall provide detailed information concerning the Prime Contractors' activities and operations detailing manpower and work activities on site. In addition, the Contractors are to submit Two Week Look Ahead schedules at every construction meeting which describes coming work in detail.
3. Each Prime Contractor shall have responsible representation at the **MANDATORY** weekly job meetings held at the Construction Manager's job office from Notice of Award through close out. These meetings will be held to arrange for satisfactory coordination of all building trades so as not to impede job progress. Prime Contractors or subcontractors who fail to attend the meetings will be back-charged $500.00 per each occurrence.
4. Each Prime Contractor shall submit two-week look ahead schedules identifying the anticipated activity, and material needs for all of the work scheduled to be formed by the Prime Contractor and his subcontractors for the identified time period. The Prime Contractor shall keep this schedule current and provide a biweekly report to the Construction Manager concerning the actual performance and activity compared to the two-week look ahead.
5. The MEP Coordination shall follow the guidelines stated below:
    a. Each Prime Contractor shall have sufficient responsible representatives at mechanical/electrical/plumbing coordination meetings held at a location to be determined. These meetings shall be held as frequently as required by the Construction Manager or any other Prime Contractor. The General Construction Prime Contractor shall also include a representative at these meetings.
    b. All Contractors are expected to jointly produce coordination drawings. Prime Contractors are to first submit their respective shop drawings for approval, to the Owner's Architect and Engineers in order to make any necessary changes prior to going through the coordination process. The HVAC Contractor shall provide black line mylars showing all of the approved ductwork. The HVAC

Contractor shall locate on these mylars all piping in orange pencil lines. The Plumbing Contractor shall locate the plumbing lines on these mylars in blue pencil lines. The Electrical Contractor shall indicate conduit runs in green pencil lines. The General Contractor will have the last coordination review. As each coordination drawing is completed, Contractors are to meet with the Owner's Representative and the Architect to review and resolve all identified conflicts on the coordination drawings. Note: for areas without HVAC work, the Mechanical Prime shall provide the necessary mylars with black line. All coordination meetings will be held at the Construction Manager's office.

c. It is the responsibility of the Prime Contractor for General Construction to coordinate all points of entry through the foundations, slab penetrations, sleeves, roof openings and penetrations, wall openings and penetrations etc. with the work of all other Prime Contractors, including but not limited to M. E. P. Primes, kitchen equipment, casework and casework accessories.

d. It is the responsibility of each Prime Contractor to coordinate with the architectural details and elements, such as soffits, variations in ceiling height and materials, fire/smoke partitions or barriers, folding partition, doors, lockers, and any other general construction items that impact the space above the ceiling or otherwise requiring light framing and/or miscellaneous support or bracing.

6. If any Prime Contractor fails to keep the site safe and clean within four hours of being notified by the Construction Manager either verbally or in writing, the Construction Manager will have this work performed and back charged to the appropriate Prime Contractor at prevailing overtime rates plus 15%. Notice to field personnel is deemed notice to the Prime Contractor.

7. Dust and fume control is essential to the reduction of health risks to the surrounding personnel. Methods of dust control shall include but not be limited to the following:

    a. Adequate ventilation, including negative air equipment and separation of areas in place during all times of demolition and as necessary during construction to prevent dust from leaving the construction work area into a cleaned area.
    b. Wetting down.
    c. Keeping bags of insulating materials, cement, etc. closed.
    d. Controlled mixing of materials under field conditions.
    e. Special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials.
    f. Job housekeeping must be maintained.
    g. Advising all personnel of hazardous conditions, including supervisors and workers.
    h. <u>Each Prime Contractor shall be responsible for instituting the above policies to ensure minimal impact to surrounding occupied areas.</u>

8. Each Prime Contractor shall confine operations on the premises to areas designated by the Construction Manager and permitted by law, ordinances, permits and the Contract Documents, and shall not unreasonably encumber the premises with any materials or equipment. The Prime Contractor shall coordinate all of his operations with, and secure approval from, the Construction Manager, before using any portion of the premises. Field personnel are to be confined to the work area assigned.

9. Where material is specified to be furnished by others or furnished and delivered only, the Prime Contractor installing the material shall be responsible for scheduling the delivery and receiving, unloading,

storing, handling, relocating, hoisting, distribution, laying out and installing this material. Upon receipt by the Prime Contractor installing the material, risk of loss and damage shall be borne by that Contractor.

10. All Prime Contractors and their subcontractors shall allow sufficient time to inspect and accept the work of the previous Contractors. Should any discrepancies be discovered, the Construction Manager shall be notified sufficiently in advance so that corrective action can be agreed to and taken (by all necessary parties) without affecting the progress of any Contractor or the work.
11. All Prime Contractors are advised to exert utmost care and diligence when working in or near any existing buildings or site work which is to remain. The absence of protection around such items shall not excuse the Prime Contractor from his liability to provide protection. Any damages to the existing buildings, sitework or facilities shall be repaired and expensed to the responsible Prime Contractor.
12. Each Prime Contractor shall be solely responsible to remove and replace the existing ceiling tiles and grid in areas of the existing building where their work is required but new ceilings are not scheduled. In the event that the existing ceilings are damaged and cannot be replaced to the satisfaction of the Owner, the responsible Prime Contractor shall be solely responsible for replacing, in kind, the existing ceilings with new tile and grid. A qualified Contractor, acceptable to the Owner, shall perform all ceiling replacements.
13. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed on an after-hours basis. The performance of this work shall be projected on the required schedules and the Owner and Construction Manager are to be notified at least forty-eight hours in advance of commencing with this work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Prime Contractor performing the work.
14. At the same time the Prime Contractor submits their Insurance Certificate they shall also submit to the Construction Manager the labor rates of each category of labor for which he or his subcontractors shall employ (either directly or indirectly). This information shall be itemized in the format shown below.

Contractor's Name					
Contractor's Address					
Contractor's Office Phone					
Contractor's Fax Number					
Contractor's Email Address					
Labor Rate Breakdown					
Worker's Title		**Journey man**	**1.5 Rate**	**Fore man**	**1.5 Rate**
Base Hourly Rate					
Payroll Tax & Insurance:	**% Per Hr**				
FICA					
Federal Unemployment					
State					

Workers Compensation					
Disability					
Other (Explanation Required)					
Subtotal					
Benefits:	**$ Per Hr**				
Vacation					
Health & Welfare					
Pension					
Annuity					
401K Fund					
Other (Explanation Required)					
Other (Explanation Required)					
Subtotal					
Hourly Labor Rate					

VII. REQUEST FOR INFORMATION (RFIs)

1. Please refer to the specifications for Construction Phase Clarifications-Request For Information from Architect's Office" for a complete explanation of the process and copy of RFI form.

VIII. TESTING/INSPECTIONS

1. If the Architect or Owner determines that any work 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's and Construction Manager's personnel.

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 Construction Manager and testing lab and submit schedule of required tests one week in advance.
    e. Coordinate inspections

3. As they relate to the timely prosecution of the work, all Prime Contractors shall coordinate independent testing and inspections. If any Prime Contractor fails to coordinate such inspections and additional costs are incurred by the Owner, the Prime Contractor will be responsible for that additional inspection cost.

4. **The following is a list of intended inspections:**

a. Soil bearing, sub-grade inspection and/or compaction
b. Concrete field and plant testing & rebar placement
c. Masonry or stone field inspection, mortar sampling, reinforcement placement inspection
d. Structural steel shop, field welding, bolting, connections, and metal deck
e. Asphalt and sub-base inspection
f. Soil compaction, density and sieve analysis testing, soil bearing
g. Water and air infiltration for windows
h. Roofing, flashing, waterproofing
i. Under slab plumbing work
j. Underslab electrical work
k. Firestopping
l. Fireproofing
m. Asbestos air monitoring
n. Electrical Contract will be required to obtain a UL inspection for the electrical installation
o. Fire alarm system
p. Sprinkler system

5. ***All material and constructability testing costs will be paid by the General Construction Prime and the as a part of his bid, associated with work as a part of his contract. This is with exception to environmental testing which will be paid by the Owner for Asbestos abatements.***

6. Architect and Construction Manager shall be notified forty-eight 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 such tests and any corrective work that testing reveals to be necessary.

IX. CHANGES TO THE WORK

1. Refer to the General Conditions for additional information pertaining to this subject.
2. All change proposals for extra work by the Prime Contractors shall be submitted to the Construction Manager, with a complete labor and material breakdown and on the basis of net difference in quantities. The Owner reserves the right to request adequate back up such as invoices, subcontractor quotes, etc., to substantiate the change order cost. Current labor rates for all trades are to be submitted to the Construction Manager by the respective Prime Contractors at the first scheduled job meeting. When both additions and deductions are involved in any one change, the allowance for overhead and profit shall be figured on the basis of net increase or decrease. All change requests shall include the following breakdown:

    a. Materials (itemized breakdown)
    b. Labor (itemized breakdown)
    c. Insurance
    d. **Subtotal**
    e. Overhead 10%
    f. Subtotal
    g. Subcontractor work (same as above, subcontractor O & P 10%)
    h. Subtotal

i. Profit 5%
j. Subtotal
k. Rental of equipment (itemized breakdown)
l. Bond charges 2%
m. Total change order

X. SCHEDULE OF VALUES/PAYMENTS

1. Within one week after Notice to Proceed, the Prime Contractor shall submit a detailed billing breakdown on the AIA G702/ G703 form for approval by Construction Manager and Architect. 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 pay application. The schedule of values will take into account and include at minimum the following items, percentages noted are maximum values for the line item noted:

   a. Bond/insurance based on actual invoice amount
   b. Labor and material on line items as applicable
   c. Submittals - 1% of contract sum
   d. Punch list - 1% of contract sum
   e. Close-out documents/warranties - 3% of the contract sum
   f. Meeting Attendance & Meeting Documentation - 2% of the contract sum
   g. Allowances
   h. Approved Alternates
      a. Labor and Material breakdown for each line Item

   Note: Punch list value will be dispersed only when the work has been confirmed to be completed 100%. **ALL PAYMENT APPLICATIONS SHALL INCLUDE A 5% RETAINAGE FACTOR.**

3. The Owner has elected to require the Prime Contractor to submit releases of liens with respect to all Work previously performed and for which payments were made under a preceding application. Beginning with the second payment requisition and with each subsequent payment requisition, each Prime Contractor shall furnish to Owner the following documents:
   a. Labor and/or Materials Affidavit
   b. Daily and Weekly Wage Affidavit
   c. Prime Contractor's-Partial Release and Wavier of Lien

4. Monthly Payment Applications for Payments shall be made as per Article 9 of the General Conditions of the Contract

XI. PUNCH LIST:

1. Upon substantial completion of each phase of work, the Prime Contractors are to submit to the Owner/Construction Manager a letter declaring the work is substantially complete. Included with said

letter is to be the Contractor's punchlist. Upon the receipt of same, the Construction Manager will schedule with the Owner, Architect, and Contractor a walk through to develop a single final punchlist. This single final punchlist shall serve as the only punchlist. Upon failure to complete the final punchlist within two weeks from receipt, the Owner reserves the right to complete same and backcharge to the Contractor the costs of material, labor, supervision and other incidentals to complete the punchist.

XII. INSURANCE/INDEMNIFICATION

1. All Prime Contractors must issue a Certificate of Insurance with liability limits as defined in the Construction Documents naming Triton Construction Company, the Architect, and the School District as an 'Additional Insureds' in addition to all other parties as stipulated in the General Conditions of the Contract in the project manual.
2. All Prime Contractors agree to indemnify and hold harmless Triton Construction Company, The Architect, the School District, its agents and employees in addition to all other parties as stipulated in the General Conditions of the Contract in the project manual.
3. All Prime Contractors and Sub-Contractors/sub-subcontractor's/vendors/etc. insurance/indemnification shall comply with Article 10 "Insurance Requirements" and Article 12 "Indemnification" as specified in the General Conditions of the Contract in the project manual.

Specific Scope Requirements for Each Prime Contractor

Prime Contractor for General Construction (PCGC)

1. This Prime Contractor shall provide, for all the building construction work, all necessary site refuse containers and disposal services to maintain the site in a clean and safe condition. This Prime Contractor shall be responsible for emptying and/or replacing all containers on a regular basis or when full. All containers and disposal services shall be provided by a single entity. This Prime Contractor shall provide sufficient labor to keep the site clean on a daily basis and shall be responsible for providing the daily broom cleaning as necessary to maintain site safety.
2. This Prime Contractor shall coordinate with the; Electrician, Plumber, Mechanical and Roofing Contractors to allow all Contractors unabated access to the building and surrounding work areas.
3. This Prime Contractor shall provide and maintain temporary chemical toilets for the duration of the Project. The quantity of these toilets should be as required to properly maintain sanitary facilities and easy access for the number of personnel on the job. This quantity shall be a minimum of two toilets per major work area of which at least one shall be for female personnel. This requirement shall include all necessary paper products, supplies and services, as well as the maintenance of these toilets until all work is complete and the Owner assumes partial occupancy of the building additions and renovations. As a minimum, this Contractor shall include the pumping and servicing of these toilets twice per week.
4. All Scaffolding or stair towers shall be designed and stamped by a licensed NYS PE. When designing this scaffolding consideration should be given to the environment, scaffolding system being used, means of access, means of tying the scaffolding to the structure, location, length of time to be erected, climate

conditions, wrapping/containment of building, purpose of use, loadings, etc. all scaffolding and/ or stair tower access points must be secured while not in use. If and when needed, the scaffolding may be used for access by other Prime Contractors during construction- this contractor will not restrict access by others using the scaffold.

5. This Prime Contractor shall provide testing and inspection of the scaffolding on a daily basis and per governing regulation (e.g.,: OSHA). A log of these inspections are to be kept in the PCGC's job trailer, along with inspections tags that identify the status of the scaffolding (inspection dates, okay to use, caution, danger). Report to the Construction Manager all corrective work required through the course of the project.
6. As shown on the logistics plan, this Prime Contractor shall include in his bid price, all costs to provide an 8' ht. rental type chain link construction fencing and gates. All fencing shall have a tightly woven, blind screen mesh installed on the "construction" side of the fence. Mesh to be dark green or black. When directed by the Construction Manager, the Prime Contractor shall remove and dispose of this fencing and all related materials. Gates for man access shall be passive to the exterior of the jobsite during the event of an emergency, but remain closed for un-authorized entry during construction. All gates shall be locked when the site is not active, with a double-keyed system, granting the Owner access to the site after-hours. Included in his bid price, this Prime Contractor shall allow a 1,000 lf allowance of orange netting, to be used at the direction of the Construction Manager, Architect or Owner.
7. This Prime Contractor shall perform its steel erection according to their Site Logistics/Safety Plan. Booming steel over the Existing Building will not be permitted while occupied. Steel erection within 20 feet of an occupied building/space will require after-hours crane picks.
8. This Prime Contractor will repair, replace, correct, or finish grade, topsoil, and seed all areas with-in the construction site that was disturbed by the work of the Project.
9. This Prime Contractor shall provide and maintain all temporary plastic barriers, partition walls, doors, hardware and plywood barriers for the duration of the project to separate work areas from public areas and to maintain security, dust, and noise control. Temporary partitions and doors will be painted with 1x coat of primer and 2x coats of paint for esthetics.
10. Construction Signage. The Prime Contractor shall include in his base price all construction signage required by OSHA. At the site fence, "Construction Area keep out", "Hard Hats Required" and "Authorized personal only" signage shall be posted every 25' on site fencing. The Prime Contractor shall reference the logistics plans for each Project to include any other signage designated for entry gates. Signs shall be made of either metal of durable PVC to endure the project duration.
11. Professional Cleaning: The PCGC shall provide a professional commercial cleaning service to prepare all areas of interior construction for use and to provide a final cleaning after substantial completion is achieved and after direction to provide such service is received form the Construction Manager. This work shall be completed in cooperation with the building maintenance staff and their respective procedures. As part of this service, the PCGC shall wax all new or repaired floors, and, wash or clean all walls, doors, windows, frames, casework, blinds, unit ventilators, shelves, counters, toilet fixture, sinks, equipment, etc. All work shall be performed in place or on site and does not include sending items out for service or special cleaning operations. Building Services shall provide this Contractor with the necessary paper products, hand soaps, trash liners and other products to fill (one time) any dispensers or accessories in order for these items to be prepared for use.

12. Unless specifically noted on the contract documents, the Prime Contractor for Site Construction will provide all concrete equipment pads outside the building as shown on the contract documents, except for gas meter pad and electrical service pads. All Primes will provide pad sizes and locations. All Primes will provide their own equipment pads inside the building.
13. This Prime Contractor is responsible for protection of finished work. Including but not limited to; floors, walls, and doors. This General Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
14. This Prime Contractor should note there are areas where the existing ceilings are remaining. The Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's Work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Contractor.
15. Unless otherwise noted in the construction documents, the Prime Contractor will repair and patch all walls, floors, and ceilings to match adjacent finishes after the removal of interior partitions, ceilings, floors, M.E.P. SP. Conduit, piping and ductwork. This includes all walls and ceilings above finished ceilings or spaces. Each Prime Contractor will cut and cap their own work inside finished walls, floors and ceilings.
16. This Prime Contractor shall provide fire extinguishers for the life of the project, the extinguishers are to be hung and identified as per OSHA requirements (1 per 3000 sq ft, or better). These extinguishers are to be re-charged and inspected for the life of the Project.
17. If due to location of fabrication plant, a local storage yard is required, all cost associated with this storage yard including receiving, unloading, storing, shake-out, reloading, and delivery to the site shall be this Prime Contractors' cost.
    a) The Owner may have an Inspector at the plant during the fabrication period. Appropriate access shall be provided at all times for this individual.
18. Shoring/ Support of Excavation: This Prime Contractor will be responsible for hiring a license NYS PE to design a shoring and underpinning plan in effort to build adjacent to existing structures.
19. Soil Erosion: This Prime Contractor will be responsible to establish and maintain a soil erosion fence around the disturbed site for the building foundation, until authorized by the Civil Engineer to remove such provisions. Reference shall be made to the construction plans & documents for additional Soil Erosion provisions required by this Prime Contractor.
20. Building Excavation for Foundations: This Prime Contract is responsible for excavation of the site for construction of foundations and slabs on grade for the new addition including the connecting corridor from the addition to the existing building. This Prime Contract shall backfill the excavation along with compaction of the soil around the foundation to within one foot of grade. The Prime Contract for Site shall be responsible for the balance of the backfill and compaction of the soil around the building from one foot below grade to finish grade.
21. Abatement Work: This Prime Contractor will be responsible to hire a qualified and DOL licensed Abatement Contractor to perform the Hazardous Material removal at areas involved. This work will only take place during the summer recess. If the work is unable to be completed by the end of the summer, abatement will only take place during prolong holiday weeks after students return.
22. Under slab MEP Trenching at New Slabs: This Prime contractor will be responsible to coordinate with his subcontractors and other Prime Contractors through the Contract Documents and the Coordination

Drawings, for any under-slab piping. This Prime Contractor (PCGC) will be responsible to provide the trenching, bedding, backfill and compaction for such MEP under-slab items. This Prime Contractor (PCGC), the PCGC's subcontractors and other Prime Contractors will be responsible to provide a final layout to the PCGC, prior to trenching. Each MEP contractor will be responsible to level the piping with provided bedding from the PCGC, testing the piping prior to back filling.

23. Trenching at existing slabs: This Prime contractor will be responsible to coordinate with his subcontractors to survey, sawcut, trench, lay bedding, backfill trench, dowel existing slab and place new concrete to be level to receive new floor finishes. Where slabs are receiving new floors, This Prime Contractor (PCGC) will provide any corrective patching to the top-of-slab and install the new finish floor. Where existing flooring is to remain and be patched; this Prime Contractor will also be responsible to match the existing finish, prepare and install new material, at approval of the Architect and Construction Manager.
24. This Prime Contractor is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work., including their subcontractors.
25. This Prime Contract shall furnish and install all blocking for work under this Contract and blocking required by other Prime Contracts.
26. This Prime Contract shall install Access Panels, provided by other Prime Contracts.
27. This Prime Contract shall install sleeves in foundation walls provided by other Contracts.
28. This Prime Contract shall paint all work above ceiling at locations there where a ceiling exposes the work above the ceiling or there is no ceiling installed. Coordinate praying of other trades work with other Prime Contracts.
29. This Prime Contract shall coordinate Roofing work with the other Prime Contracts, General Construction, Plumbing, Mechanical and Electrical, as necessary to complete the scope of work under this Contract.
30. This Prime Contract shall provide a field trailer, as described in 01 50 00 Temporary Facilities and Controls, for use by the Owner/CM and Architect from June 1, 2025 to the end of the project, final completion.
31. Temporary Heat: This Prime Contract PCGC shall provide temporary heat between October 1st and April 30th as needed for the entire project to assure that the work of all Primes/trades can continue through the winter months. This includes temporary heating equipment, maintenance, fuel, fire watch, necessary labor/supervision, ventilation, temporary enclosures etc. In no case shall the temperature be less than 50 degrees F. Select equipment that will not have a harmful effect on completed installations or elements being installed. The fuel sources for the equipment must be located outside the building envelope. Assume the building is not closed in; shrink wrap may be required.
    The PCGC Contract shall assume there will be construction during the cold weather months and must include provisions for providing temporary heat for work activities requiring heat and cold weather protection such as but not limited to masonry and concrete construction activities.
32. Ventilation & Humidity Control: This Prime Contract PCGC shall provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
33. This Prime Contract PCGC is responsible to maintain a watertight building enclosure and install temporary enclosures at openings (windows, doors, louvers, clerestory, storefront etc) in order to achieve a water tight building and achieve an environment capable of being temporarily heated.
34. This Prime Contract PCGC will install items supplied by the Owner such as but not limited to toilet

accessories.

35. This Prime Contact PCGC will install the Walk-in Refrigerator and Freezer that is located in the kitchen area and is supplied by the Owner.
36. This Prime Contract PCGC will construct the foundation walls and ramp that provide exterior access the lower level of the addition. This work shall be coordinated with the Sitework Contract.
37. This Prime Contract PCGC shall construct a weathertight and insulated wall at the location of the corridor connection to the existing building. This work shall be scheduled so that it is completed prior to the start of the School Year and start of the corridor connection or if during the school year scheduled during a holiday break.

Prime Contractor for Plumbing (PCP)

1. The Prime Contractor for General Construction (PCGC) shall provide dumpsters for this trade. Each Contractor is responsible for collecting, moving, placing, breaking down boxes and pallets, and disposing rubbish, on a daily basis, all debris from their activities into a dumpster supplied by the PCGC. Each Prime Contractor is responsible to broom clean the areas they worked in at the end of each day.
2. The Prime Contract for Plumbing shall include, as part of his base price, all costs associated with providing one hose bib for temporary water service at work area (if this hose bib does not already exist). The Prime Contractor for Plumbing shall install the hose bibs at locations designated by the Construction Manager or where needed by the other Prime Contracts.
3. This Prime Contract for Plumbing should note there are areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's Work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Prime Contract.
4. Unless otherwise noted in the construction documents, this Prime Contract will cut and cap their own work inside finished walls, floors and ceilings.
5. Each Prime Contract is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.
6. This Prime Contract is responsible for protection of finished work. This Prime Contract will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
7. Trenching under slab (New/Existing): This Prime contractor will be responsible to coordinate with his subcontractors and other Prime Contractors to survey, sawcut, trench, lay bedding, backfill trench, dowel existing slab and place new concrete to be level to receive new floor finishes. Where slabs are receiving new floors, this Prime Contractor will provide any corrective patching to the top-of-slab and coordinate with the Prime Contract for General Construction and their installation of the new finish floor. Where existing flooring is to remain and be patched; this Prime Contractor will be responsible to match the existing finish, prepare and install new material, at approval of the Architect and Construction Manager.
8. This Prime Contract PC is responsible to bring Sanitary and Storm piping to five (5) feet outside of the building walls connection to piping for same installed by the Site Contract.

9. Unless specifically noted on the contract documents, the Prime Contractor for Site Construction will provide all concrete equipment pads outside the building as shown on the contract documents, except for gas meter pad and electrical service pads. All Primes will provide pad sizes and locations. All Primes will provide their own pads inside the building.
10. This Prime Contract PC is responsible for providing and installing the fence around the gas meter as required by the Utility company.
11. This Prime Contractor shall provide fire extinguishers for their specific work that will create a fire hazard. These extinguishers are to be re-charged and inspected for the life of the project.
12. This Prime Contract shall identify the locations of and required blocking for their installations by Prime Contract GC.
13. This Prime Contract shall provide Access Panels, dimensions and locations to Prime Contract GC for installation.
14. This Prime Contract is responsible for cutting and patching of existing construction including finish patching associated with this Contract Work. Other Contracts are responsible for their own cutting and patching unless noted otherwise.
15. This Prime Contract shall provide sleeves and other materials including dimensions and locations to the Prime Contract GC for installation.
16. The Prime Contract for Plumbing shall include, as part of his base price, all costs associated with providing one hose bib for temporary water service at work area (if this hose bib does not already exist). The Prime Contractor for Plumbing shall install these hose bibs at locations designated by the Construction Manager or where needed by the other Prime Contracts.
17. This Prime Contract shall furnish all starters required for plumbing equipment installed under this Contract to the Electric Prime for installation.
18. This Prime Contract shall provide plumbing connection to equipment furnished by another Prime Contract or Owner.
19. This Prime Contract shall coordinate the Contract work above ceiling with the Prime Contract for General Construction for painting of the work above the ceiling as noted on the Contract Documents.
20. This Prime Contract Plumbing (P) is responsible for all work associated with the installation of new domestic water and fire service for this project including but not limited to coordination with the Utility company and Prime Contract Site Construction (PCSC).
21. This Prime Contract Plumbing (P) is responsible for all work associated with the installation of new gas service for this project including but not limited to coordination with the utility company and Prime Contract Site Construction (PCSC).
22. This Prime Contract Plumbing (P) is responsible for all work associated with the installation of the sprinkler system for this project including all engineering for shop drawings and testing and inspections for the system after installation
23. This Prime Contract Plumbing (P) shall supply and install sediment traps at the art room sinks.
24. This Prime Contract Plumbing (P) will extend the sanitary piping that must be connected to the grease trap to 5’0” outside the exterior wall of the building and coordinate with Site Contract for them to connect the grease trap.

Prime Contractor for Mechanical (PCM)

1. The Prime Contractor for General Construction (PCGC) shall provide dumpsters for this contractor to use for day-to-day rubbish. Each Contractor is responsible for collecting, moving, placing, breaking down boxes and pallets, and disposing rubbish, on a daily basis, all debris from their activities into a dumpster supplied by the PCGC. Each Contractor is responsible to broom clean the areas they worked in at the end of each day. This Prime Contractor will include in his bid price the provision to remove large HVAC equipment from the site, at his own costs, including but not limited to RTUs, Chillers, Cooling Towers, Unit Ventilators, and Air Handlers.
2. This Prime Contract for Mechanical should note there are areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Prime Contract..
3. Unless otherwise noted in the construction documents, this Prime Contract will cut and cap their own work inside finished walls, floors and ceilings.
4. Each Prime Contract is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.
5. Each Prime Contract is responsible for protection of finished work. This contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
6. Both louvers openings and duct-work openings in walls, slabs or roof, will be provided by this prime contractor. This Prime Contractor (Mechanical) will be responsible for all openings they require for their Contact work, including saw cutting, core-drilling and alike as well as any structural support necessary.
7. Trenching under slab (New/Existing): This Prime contractor will be responsible to coordinate with his subcontractors and other Prime Contractors to survey, sawcut, trench, lay bedding, backfill trench, dowel existing slab and place new concrete to be level to receive new floor finishes. Where slabs are receiving new floors, this Prime Contractor will provide any corrective patching to the top-of-slab and coordinate with the Prime Contract for General Construction and their installation of the new finish floor. Where existing flooring is to remain and be patched; this Prime Contractor will be responsible to match the existing finish, prepare and install new material, at approval of the Architect and Construction Manager.
8. Unless specifically noted on the contract documents, the Prime Contractor for Site Construction will provide all concrete equipment pads outside the building as shown on the contract documents, except for gas meter pad and electrical service pads. All Primes will provide pad sizes and locations. All Primes will provide their own pads inside the building.
9. This Prime Contractor shall provide fire extinguishers for their specific work that will create a fire hazard. These extinguishers are to be re-charged and inspected for the life of the project.
10. This Prime Contract shall identify the locations of and required blocking for their installations by Prime Contract GC.
11. This Prime Contract shall provide Access Panels, dimensions and locations to Prime Contract GC for installation.
12. This Prime Contract is responsible for cutting and patching of existing construction including finish

patching associated with this Contract Work. Other Contracts are responsible for their own cutting and patching unless noted otherwise.

13. This Prime Contract shall provide sleeves and other materials including dimensions and locations to the Prime Contract GC for installation.
14. This Prime Contract shall furnish all starters required for mechanical equipment installed under this Contract to the Electric Prime for installation.
15. This Prime Contract shall provide mechanical connection to equipment furnished by another Prime Contract or Owner.
16. This Prime Contract shall install low voltage wiring for Mechanical systems.
17. This Prime Contract shall coordinate the Contract work above ceiling with the Prime Contract for General Construction for painting of the work above the ceiling as noted on the Contract Documents.
18. This Prime Contract is responsible for furnishing and installing all the Exhaust Hoods for Kitchen equipment including but not limited to fire suppression system, lighting, fans and control wiring.
19. This Prime Contract is responsible for furnishing and installing all the Hoods for Kiln equipment including but not limited to fans and control wiring.
20. This Prime Contact will install the mechanical equipment for the Walk-in Refrigerator and Freezer that is located in the kitchen area and is supplied by the Owner.

Prime Contractor for Electrical (PCE)

1. The Prime Contractor for General Construction (PCGC) shall provide dumpsters. Each Prime Contractor is responsible for collecting, moving, placing, breaking down boxes and pallets, and disposing rubbish, on a daily basis, all debris from their activities into a dumpster supplied by the PCGC. Each Prime Contractor is responsible to broom clean the areas they worked in at the end of each day.
2. The Prime Contractor for Electrical is to temporarily support existing ceiling mounted equipment/devices (i.e., speakers, fire alarm apparatuses, exit signs, wiring, light fixtures, etc.) as required for demolition of existing ceilings until new equipment/devices are installed or existing equipment/device can be permanently remounted in the new ceiling.
3. The Prime Contractor for Electrical shall provide and keep temporary light and power operational for a period of from fifteen minutes before the earliest starting time of the earliest trade, to fifteen minutes after the established quitting time of the trade which stops latest in the evening (fifteen foot candles) throughout the entire building (normal working hours 7:00 am to 4:00 pm). This applies to all scheduled workdays, Monday through Saturday inclusive, which are established as regular workdays for any trade engaged in the work, including such days that are holidays for Electricians but are regular workdays for other trades. These services are to be kept operational until the Construction Manager determines that they are no longer required for the execution of the work. Temporary light shall consist of a minimum of (1) bulb and cage per 10 square feet of floor space in all spaces no matter of size throughout the existing building spaces being renovated..
4. The Prime Contractor for Electrical shall include in his base price all costs associated with providing and maintaining adequate temporary light and power to all areas of work required by the construction documents. Each major area of work shall be provided with an adequate sized distribution panel for temporary light and power

5. The Prime Contractor for Electrical shall provide temporary power for masonry work, mixers, steel work, or fire proofing work, compressors etc. that may require 220V temporary power. Power is to be provided at each major area of work if required.
6. The Prime Contractor for Electrical should note there are areas where the existing ceilings are remaining. This Contractor will be required to remove and reinstall any ceilings displaced by installation of this Contractor's work. If open ceilings are not replaced within a twenty-four hour period after a request by the Construction Manager, either verbal or written, the Construction Manager will have said ceilings reinstalled and all related costs will be back charged to said Contractor.
7. The Prime Contractor for Electrical shall replace all burned out light bulbs when building is turned over to the owner at substantial completion.
8. This Prime Contractor shall coordinate with the Site Contractor, General Contractor, Plumber, and Mechanical Prime Contractors to allow all Contractors unabated access to the building.
9. Unless otherwise noted in the construction documents, this Prime Contractor will cut and cap their own work inside finished walls, floors and ceilings.
10. Each Prime Contractor is required to fire stop and/ or smoke stop all walls, floors and ceilings after completion of all their own work.
11. This Prime Contractor is responsible for protection of finished work. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
12. This Prime Contractor will modify all existing Fire Alarm devices that are part of the existing building being renovated, maintain the devices throughout construction, and or disconnect as needed. This Prime Contractor will assure that no troubles exist, by hiring a Fire Alarm vendor who is licensed to modify the existing Fire Alarm system to accept any temporary changes through construction.
13. This Prime Contractor is to develop a separate site-specific electrical service shutdown/upgrade schedule within four weeks after Notice to Proceed. This schedule will be developed in conjunction with the Construction Manager and the Owner. No shutdown/transfer will be permitted at any time without prior written notification. The Prime Contractor for Electrical shall provide temporary power for all 'others' work ongoing at the site during any electrical shutdown or transfer period that would otherwise deny other Contractors power. No shutdown or transfer shall be allowed during active school hours. Any and all shutdowns must be scheduled on the Owners off days (weekends, holidays). Any shutdown longer than three days will require this Prime Contractor to supply temporary power for the Owner (i.e., generators). The Electrical Prime Contractor shall provide a minimum of forty-eight hours' notice to the Owner and the Construction Manager or any necessary power shutdown.
14. <u>Trenching under slab (New/Existing):</u> This Prime contractor will be responsible to layout all locations for any under slab piping. The Prime Contractor for General Construction will be responsible to include trenching provisions for under-slab work where indicated on the plans at new slab locations. This Prime Contractor will lay all piping, leveling piping, test and allow the PCGC to backfill in time not to disturb the overall project schedule. This Prime contractor (PCE) will be responsible to sawcut any existing slabs required to install piping, trench, lay bedding and patch the slab to accept new finishes provide by a skilled tradesman hired by this Prime Contractor.
15. Unless specifically noted on the contract documents, the Prime Contractor for Site Construction will provide all concrete equipment pads outside the building as shown on the contract documents, except

for gas meter pad and electrical service pads. All Primes will provide pad sizes and locations. All Primes will provide their own pads inside the building.

16. This Prime Contractor shall provide fire extinguishers for their specific work that will create a fire hazard. These extinguishers are to be re-charged and inspected for the life of the project.
17. This Prime Contract shall identify the locations of and required blocking for their installations by Prime Contract GC
18. This Prime Contract shall provide Access Panels, dimensions and locations to Prime Contract GC for installation.
19. This Prime Contract is responsible for cutting and patching of existing construction including finish patching associated with this Contract Work. Other Contracts are responsible for their own cutting and patching unless noted otherwise.
20. This Prime Contract shall provide sleeves and other materials including dimensions and locations to the Prime Contract GC for installation.
21. After ceiling demolition, this Prime Contract shall re-support all hanging electrical and data lines.
22. This Prime Contract shall install all starters furnished by other Prime Contracts.
23. This Prime Contract shall provide electrical connection to equipment furnished by another Prime Contract or School District.
24. This Prime Contract shall coordinate the Contract work above ceiling with the Prime Contract for General Construction for painting of the work above the ceiling as noted on the Contract Documents.
25. This Prime Contract is required to wire the exhaust fans and hood lighting for the exhaust hood installed by the Mechanical Contract.
26. This Prime Contract shall provide power to the temporary field trailer for the Owner/CM/Architect that is provided by the General Construction Contract.
27. This Prime Contact will provide and install the electrical wiring for the Walk-in Refrigerator and Freezer that is located in the kitchen area and is supplied by the Owner.
28. The Owner will be providing all equipment for the clocks, phones and PA system. The Electrical Contract is required to install the equipment as shown in the Contract Documents. All items required for a complete and operation system(s) is the responsibility of the Electric Contract.

Prime Contractor for Site Construction (PCSC)

1. The Site Contractor shall provide, for the site work project, all necessary site containers and disposal services to maintain the site in a clean and safe condition. The containers provided by this Contract shall be marked Site material only. This Prime Contractor shall be responsible for emptying and/or replacing all containers on a regular basis or when full. All containers and disposal services shall be provided by a single entity. Prime Contractor shall provide sufficient labor to keep the site clean on a daily basis and shall be responsible for providing the daily broom cleaning as necessary to maintain site safety.
2. The existing staging area chain link fence at the Project Site can be used to secure the area during construction. At any point where there is no fence in place during the removal and reinstallation of existing and new fence, this Prime Contractor will be responsible to secure the site with orange snow netting -including maintenance- to keep the temporary fencing erect. In addition, this contractor shall allow 1,000 lf of orange snow netting for use at the Owner or Construction Manager's discretion.

3. This Prime Contractor will hire the services of an underground utility surveyor to locate and mark all existing underground utilities and services with-in the Area of Work.
4. This Prime Contractor is responsible for protection of finished work. This Prime Contractor will provide, maintain, and remove the appropriate protection materials necessary to adequately protect his finished product.
5. This Prime Contract is responsible to maintain the staging area including temporary fencing and tracking pads. Upon completion of the construction project this Prime Contract shall remove the temporary fence and other temporary construction items and restore the area as necessary to a finished condition.
6. Soil Erosion: This Prime Contractor will be responsible to establish and maintain a soil erosion fence around the disturbed site during the entirety of construction, until authorized by the Civil Engineer to remove such provisions. This Prime contractor will also provide erosion control at each existing and new nearby storm basin structure. Reference shall be made to the construction plans & documents for additional Soil Erosion provisions required by this Prime Contractor.
7. Sprinkler Piping for Irrigation: This Prime contractor will provide the removal and reinstallation of existing underground sprinkler piping back to its sources, per the Contract Documents.
8. Underground Drainage: This Prime Contractor will include all the costs to provide the removal of existing, and the reinstallation new under-ground drainage. Reference should be made to the Construction Documents.
9. Building Excavation for Foundations: The Prime Contract for General Construction is responsible for excavation of the site for construction of foundations and slabs on grade for the new addition including the connecting corridor from the addition to the existing building and the foundation wall and ramp that provides access to the lower level of the addition. The General Construction Prime Contract shall backfill the excavation along with compaction of the soil around the foundation to within one foot of grade. This Prime Contract for Site shall be responsible for the balance of the backfill and compaction of the soil around the building from one foot below grade to finish grade.
10. This Prime Contract SC is responsible for all site concrete walkways and slabs outside of the building footprint.
11. Unless specifically noted on the contract documents, this Prime Contractor for Site Construction will provide all concrete equipment pads outside the building as shown on the contract documents, except for gas meter pad and electrical service pads. All Primes will provide pad sizes and locations. All Primes will provide their own pads inside the building.
12. This Prime Contract SC is responsible to bring Sanitary and Storm piping to within five (5) feet of the building walls for connection to piping for same installed by the Plumbing Contract.
13. This Prime Contractor will repair, replace, correct, or finish grade, topsoil, and seed all areas with-in the construction site that was disturbed by the work of this project.
14. This Prime Contractor will use the work area as the material staging and storage area.
15. This Prime Contract shall coordinate the area of storing site material with all other Prime Contracts.
16. This Prime Contract will supply and install the exterior grease trap that is connected to the sanitary lines of the kitchen. The Site Contract will coordinate with the Plumbing Contract the connection of the sanitary lines that the Plumbing Contract will extend to 5’0” outside the building.

END OF SPECIAL PROVISIONS

GENERAL CONDITIONS

of the

CONTRACT for CONSTRUCTION

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GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The within document includes detailed provisions concerning the capital improvement work to be performed by the Contractors engaged by the School District. This document contains provisions which relate particularly to capital improvement projects in the school district setting in New York State. The document is incorporated by reference into all contracts to be awarded and should be reviewed carefully by the Contractor to whom the award of contract is made. Consultation with an attorney and insurance representative is advised.

ARTICLE 1
DEFINITIONS

A. "Addendum" or "Addenda" refers to revised drawings and/or written requirements for the capital improvement work issued by the Architect prior to the time indicated for submission of a bid by a contractor.

B. "After Hours" refers to the time before or after the hours school is in session. During this time, students and staff may occupy portions of the facility or building, but may be redirected as required to allow for the completion of work by a contractor.

C. The "Architect" is the design professional engaged by the School District to perform design related functions respecting the capital improvement projects to be performed in the School District.

D. "Board of Education" refers to the Board of Education of the School District.

E. "Central Administration" refers to the Superintendent of Schools, his/her Assistant Superintendents, and Director of Plant & Facilities.

F. The "Construction Manager" is the entity engaged by the School District to act as its representative during the course of construction of the Project.

G. "Contract Documents" refers to all drawings, sketches, specifications, addenda, field directives and all other written or drawn descriptions of the products, labor and materials to be provided for the Project.

H. The "Contractor" refers to the entity engaged by the School District to perform all or a part of the capital improvement project on its behalf.

I. The "Drawings" are the plans, elevations, sections, details, schedules and diagrams developed by the Architect for the capital improvement projects to be performed in accordance with the project manual of which these General Conditions of the Contract for Construction form a part.

J. The "Off Hours" refers to a period of time during which the school facility or building shall be unoccupied, to be a duration of no less than 24 hours.

K. The "Owner" refers to the Board of Education or its designee.

L. The "Project" refers to the entire capital improvement project to be performed in accordance with the project manual and may include work by the Owner.

M. The "Project Manual" is the bound document which is issued simultaneously with the project Drawings and includes the Notice to Bidders, Information to Bidders, Bid Proposal Form, Prevailing Wage Rate schedule and the written requirements for labor, materials, equipment, construction systems and the like necessary for the Contractor to complete the capital improvement work for which it has been engaged.

N. A "Subcontractor" is a person or entity who has a direct contract with the Contractor to provide material and/or labor for the project on or off the site, or to otherwise furnish labor, material or other services with respect to a portion of the Contractor's work. A "Sub-subcontractor" is a person or entity who has a direct or indirect contract with a Subcontractor engaged by the Contractor to perform a portion of the Subcontractor's work at the site, or to otherwise furnish labor, material or other services with respect to a portion of the Subcontractor's work.

O. The term "Specialist" or "Specialty Contractor" as used in these specifications 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.

P. "Accepted", "directed" "permitted," "requested," "required," and "selected" mean, unless otherwise explained, "accepted by the Architect and/or Owner" "directed by the Architect and/or Owner," "permitted by the Architect and/or Owner," "requested by the Architect and/or Owner," "required by the Architect and/or Owner," and "selected by the Architect and/or Owner." However, no such implied meaning will be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.

Q. "As accepted" "or acceptable substitute", and "for review" mean the Architect is the sole judge of the quality and suitability of the proposed substitutions. Where used in conjunction with the Architect's response to submittals, requests, applications, inquiries, reports, and claims by the Contractor, the meaning will be held to the limitations of the Architect's responsibilities and duties as stated in the General Conditions. In no case will "accepted by the Architect" be interpreted as an assurance to the Contractor that the requirements of the Contract Documents have been fulfilled.

R. "Furnish" means supply and deliver to the Project site or other designated location, ready for unloading, unpacking, storing, assembly, installation, application, erection, or other form of incorporation into the Project, and maintained ready for use. Supply and deliver products requiring additional or supplemental fitting, assembly, fabrication, or incorporation into other elements of the Project directly to the fabricator, installer or manufacturer as required.

S. "Install" means unload, unpack, use, fit, attach, assemble, apply, place, anchor, erect, finish, cure, protect, clean, and similar operations required to properly incorporate work into the Project.

T. "Provide" means furnish and install.

U. "Replace" means remove designated, damaged, rejected, defective, unacceptable, or non- conforming work from the Project and provide new work meeting the requirements of the Contract Documents in place thereof.

V. "Unusual" refers to means and methods beyond any conventional or generally accepted standard of work or installation, generally requiring a standard of care and protection as outlined by a manufacturer's guidelines and recommendations.

W. The word "include", in any form other than "inclusive", is non-limiting and is not intended to mean 'all-inclusive.

ARTICLE 2
CONTRACTOR'S REPRESENTATIONS

A. Upon submission of its bid to the Owner, the Contractor expressly represents:

1. The Contractor represents and warrants that it performed a detailed investigation of the site(s) and that such investigation was sufficient to disclose the conditions of the site(s) at which work is to be performed by it and all improvements thereon, and the conditions under which the work is to be performed, including, but not limited to (a) the location, condition, layout and nature of the project site and surrounding areas; (b) the cost of labor, materials and equipment necessary to perform the work, the availability; (c) the areas of the work which will cause a disruption to the necessary and proper operation of the facilities by the Owner; and (d) other pertinent limitations on the performance of its work.

2. The Contractor represents and warrants that it has carefully studied and compared the drawings and pertinent provisions of the project manual and that any errors, omissions, ambiguities, discrepancies or conflicts found in said documents have been brought to the attention of the Architect for clarification prior to the Contractor's

submission of its bid. If, in the interpretation of Contract Documents, requirements within the Drawings and Specifications conflict, or it appears that the Drawings and Specifications are not in agreement, the requirement to be followed shall be decided by the Architect. Where there is a discrepancy in quantity, the Contractor shall provide the greater quantity; where there is a discrepancy in quality, the Contractor shall provide the superior quality. Addenda supersede the provisions that they amend.

3. Each trade contractor certifies to be 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, the requirement of normal "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 and/or levels at various times. This "phasing", "out of sequence", or "come back" work shall be done at no cost to other trade contractors, the Owner, Architect or the Construction Manager.

B. The Contractor warrants to the Owner that (1) the materials and equipment furnished under its contract will be of good quality and new, and of recent manufacture, unless otherwise required or permitted by the Contract Documents, (2) that its work will be free from defects not inherent in the quality required or permitted, and (3) that its work will conform with the terms and conditions of its agreement with the Owner. Work not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective and shall be removed and replaced at the Contractor's cost and expense. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

C. Except as to any reported errors, inconsistencies or omissions, and to concealed or unknown conditions, by executing the Agreement, the Contractor represents the following:

1. The drawings and accompanying specifications found in the project manual issued simultaneously with said drawings are sufficiently complete and detailed for the Contractor to (a) perform the work required to produce the results intended by the Owner and (b) comply with all the requirements of its contract with the Owner.

2. The work required to be performed by the contractor including, without limitation, all construction details, construction means, methods, procedures and techniques necessary to perform its work, use of materials, selection of equipment and requirements of product manufacturers are consistent with: (a) good and prevailing and accepted industry standards applicable to its work; (b) requirements of any warranties applicable to its work; and (c) all laws, ordinances, regulations, rules and orders which bear upon the Contractor's performance of its work.

3. The Drawings and Specifications for the Contract have been prepared with

care and are intended to show as clearly as is practicable the work required to be done. Work under all items in the Contract must be carried out to meet field conditions to the satisfaction of the Architect and Owner and in accordance with his instructions and the Contract Drawings and Specifications.

4. All dimensions shown on the Drawings are for bidding purposes only. It is the responsibility of the Contractor to verify all dimensions in the field to insure proper and accurate fit of materials and items to be installed.

D. The representations set forth herein shall survive expiration and/or termination of the Contractor's agreement with the Owner.

ARTICLE 3
CONTRACTOR'S CONSTRUCTION PROCEDURES

A. 1. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures required for the proper execution of its work on the project. Where the drawings and/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.

2. Neither the Architect nor the Owner will have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided herein.

3. The Contractor shall provide and pay for all labor, materials, equipment, tools, construction equipment and machinery, rigging, water, heat, utilities, light, transportation, and other facilities and services necessary for proper execution and completion of its work, whether temporary or permanent and whether or not incorporated or to be incorporated in its work.

B. 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 review any

specified or installation procedure with its employees and/or subcontractors, including those recommended by any product manufacturer, prior to the commencement of the relevant portion of the work to be performed. The Contractor shall be responsible to the Owner for the acts and/or omissions of 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.

C. The Contractor shall be responsible for the inspection of portions of the project performed by its own work force and/or subcontractors engaged by it for the purpose of determining that said work is in proper condition to receive subsequent work.

D. The Contractor shall perform its work in accordance with the standards of the construction industry applicable to work in the locale in which work is to be performed.

E. The Contractor shall only employ labor on the project or in connection with its work capable of working harmoniously will all trades, crafts and any other individuals associated with the capital improvement work to be performed. 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. Should it become necessary to create a separate entrance for a contractor involved in a labor dispute, all costs associated with creating that entrance shall be borne by the contractor involved in the dispute. Such costs shall include, but not be limited to, signage, fencing, temporary roads and security personnel as deemed necessary by the Owner for the safety of the occupants of the site.

F. 1. If the Contractor has engaged the services of workers and/or subcontractors who are members of trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect 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. In case the progress of the capital improvement work to be performed by the Contractor is effected by any undue delay in furnishing or installing any items or materials or equipment required pursuant to its agreement with the Owner 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 capital improvement work pursuant to its contract.

3. The Contractor shall ensure that its work continues uninterrupted during the pendency of a labor dispute.

4. 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.

G. The Contractor shall enforce strict discipline and good order among the Contractor's employees and its Subcontractors' work forces and other persons carrying out the performance of its work. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. The Owner reserves the right to object to any person to be hired or who is employed by the Contractor. Upon the request of the Owner, said person shall be removed from the Project and not again be assigned to perform the Contractor's work without the written permission of the Owner.

H. Within one (1) week after a Notice to Proceed is received, the Contractor shall employ a competent, full-time Project Manager and On Site Superintendent to be approved by the Owner or its representative, and such necessary assistants who shall be in attendance at each project site whenever and wherever work is in progress to provide for the expeditious completion of the work. Said Project Manager and On Site Superintendent shall be employed until punchlist and closeout of the Project. To the extent work is being performed contemporaneously at different facilities within the School District, the Contractor shall assign different superintendents for each facility at which work is being performed. The Project Manager and On Site Superintendent assigned by the Contractor shall not be changed except with the consent of Owner, unless the Project Manager or On Site superintendent or such assistant proves to be unsatisfactory to the Contractor and/or ceases to be in its employ. The Project Manager and On Site Superintendent shall represent the Contractor, and communications given to the Project Manager or On Site Superintendent, whether verbal or written, shall be as binding as if given to the Contractor. Oral communications to the superintendent(s) or his/her assistant(s) and/or project manager shall be confirmed in writing by the Owner, or Architect. The Contractor shall forward to the Owner a copy of the resumes for each of its superintendents, project managers and their assistants. The Owner or the Architect shall have the right to have any supervisory or management staff removed from the project with or without cause.

I. Each Contractor shall provide, or otherwise see that, the project manager, or on site superintendent site managers, and/or responsible workers of each Contractor and major subcontractor are equipped with cellular phones and radios. Each Contractor shall provide the Owner and the Architect with the number for each phone and worker.

J. 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/or 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, superintendents and/or assistants.

K 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 Prime Contractor employed by the Prime Contractor including the name, address and telephone number of each bonding company's primary contact representative for this project.

4. Detailed subcontractor schedules indicating the approximate quantity of shop drawings, sequence, timing and man loading.

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.

L. 1. Tests, inspections and approvals of portions of the Contractor's work required by the drawings and/or specifications shall be made at an appropriate time. Unless otherwise provided, the Contractor shall consult with the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to the Contract Documents and, after consulting with the Architect and Construction Manager, the Construction Manager shall advise the Owner to make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority. The Owner shall bear all costs associated with the tests, inspections or approvals required by the drawings and/or specifications except as set forth in subparagraph 3 hereof.

2. Tests, inspections and approval of portions of the Contractor's work required by laws, ordinances, rules, regulations or orders of public authorities or governmental agency having jurisdiction shall be made at an appropriate time. The Contractor shall consult with

the Architect and the Construction Manager concerning the need for testing and/or inspection of its work pursuant to law, ordinance, regulation or orders of public authorities or governmental agencies and shall advise the Owner in writing that it has made arrangements for such tests, inspections and approvals with the appropriate public authority or governmental agency. The Contractor shall be solely responsible for making timely notice of the need for a test, inspection and/or approval with the relevant public authority or governmental agencies and shall bear all costs associated with such testing, inspection or approval required by such public authority or governmental agency.

3. If the Architect, the Construction Manager, the Owner, or public authorities or governmental agencies having jurisdiction determine that portions of the Contractor's work require additional testing, inspection or approval due to the Contractor's failure to perform its work in accordance with the requirements of the Contract Documents and/or laws, ordinances, rules, regulations or orders of public authorities or governmental agencies having jurisdiction, the Architect and the Construction Manager will advise the Owner of the need for such additional inspections or tests and the Owner shall make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner. The Contractor shall bear the costs of such additional testing as provided in Article 14.

M. The Contractor shall, if required by ordinances, laws, codes, rules and/or regulations of the governing agencies having jurisdiction over this project, retain a licensed professional engineer to supervise the construction of this project including, but not limited to, foundations, structural work, soils, welding, reinforced masonry and the like.

N. The Contractor recognizes and acknowledges that the within project is governed by and subject to the provisions of New York State General Municipal Law, section 101, governing the award of contracts on public improvement projects. As such, the Contractor recognizes and acknowledges that other contractors will be performing work on the project in conjunction with it. As such the Contractor agrees to cooperate with such other contractors performing work on the project and shall perform its work as follows:

1. The Contractor shall not interfere with the erection, installation or storage upon the premises of any work, materials, supplies or equipment which is to be performed and furnished by other contractors, and the Contractor shall properly connect and coordinate its work therewith.

2. The Contractor shall not commit or permit any act which will interfere with the performance of the work of any other contractor performing work on the project. If the Contractor sustains any damage through any act or omission of 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 contractor, the Contractor shall promptly notify the Owner and the Construction Manager of such damage.

3. 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 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 or other contractor(s) 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 an offending contractor's contract sum an amount sufficient to cover such damage and all expenses and costs associated with the damage sustained.

4. 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.

5. In case of interference between the operations of different 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. The Contractor, including its subcontractors, shall keep itself informed of the progress of other contractors and shall notify the Architect or Owner's Representative 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 own work.

7. Delays or oversights on the part of any contractor or subcontractor in getting any or all of their 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.

8. If part of the Contractor's work depends for proper execution or results upon construction or operations by the Owner or another contractor, the Contractor shall, prior to proceeding with that portion of its work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or other contractor's completed or partially completed construction is fit and proper to receive the Contractor's work.

9. The Contractor shall promptly correct discrepancies or defects in its work which have been identified by other contractors as affecting proper execution and results of the work of such other Contractor.

O. 1. The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities or governmental agencies bearing on 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, (b) the Architect and its consultants, employees, officers and agents, and/or (c) the Construction Manager and its 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.

2. The Contractor shall pay any costs or fees incurred and any fines or penalties imposed as a result of any violation, including any costs or fees incurred by the Owner due to such violation. If the Contractor observes any discrepancies between portions of the Contract Documents, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be accomplished by appropriate modification to the drawings and/or specifications.

3. If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs and shall bear the total cost for correction of same.

4. If the Contractor fails to give such notices, it shall be liable for and shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its 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. The Contractor shall pay any costs or fees incurred in such compliance and any fines or penalties imposed for violation thereof and any costs or fees incurred by the Owner due to such violation.

P. The Contractor recognizes and acknowledges that job meetings will be held at the job site weekly unless otherwise designated by the Owner or the Architect. The Contractor shall have responsible representation at the MANDATORY weekly job meetings held at the Construction Manager's job office. These meetings will be held to arrange for satisfactory coordination of all trades on the project so as not to impede job progress. Contractors or subcontractors failing to attend job meetings shall be responsible for delays and/or expenses incurred due to coordination difficulty.

Q. 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.

ARTICLE 4
CONTRACTOR'S USE OF SITE

A. The Contractor shall confine operations at the site to the areas at which construction is to be performed and to such areas permitted by law, ordinances, permits and as set forth in detail in the project manual and drawings forming a part of its contract with the Owner.

B. 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.

C. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy.

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. The Contractor shall exert utmost care and diligence when working in or near any existing buildings or sitework. 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.

6. 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 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.

7. All disconnect and/or tie-in work involving any utilities that would interfere with the ongoing operations of the Owner shall be completed after hours when the facility is not in use. The performance of this work shall be projected on all schedules required to be prepared by the Contractor. Additionally, the Contractor shall give the Construction Manager and the Owner at least forty-eight (48) hours advance notice of its intention to perform this type of work. All overtime and standby personnel necessary to complete these tie-ins shall be the responsibility of the Contractor performing the work.

E. 1. Separation of construction areas from occupied spaces: 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. Methods of dust and fume control shall include, but not be limited to:

a. Adequate ventilation;
b. Wetting down;
c. Keeping bags of insulating materials, cement, etc., closed.
d. Controlled mixing of materials under field conditions;
e. Special attention should be utilized in sawing of insulation and certain acoustical materials and storage of materials.
f. Job housekeeping must be maintained;
g. Advising all personnel of hazardous conditions, including supervisors and workers;

Each contractor is responsible for instituting the above policies to insure minimal impact to surrounding occupied 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.

F. 1. Storage space will be allotted to the Contractor by the Owner, to the extent such space, in the sole discretion of the Owner is available. The Contractor shall be responsible for securing appropriate space for its material with the Construction Manager prior to delivery. If insufficient space is available on the site, the Contractor shall provide local 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.

2. The Contractor shall schedule delivery of materials and equipment to minimize long term storage at the Project, to prevent overcrowding of construction spaces, and to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.

3. The Contractor shall deliver materials and equipment to the Project in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installation. The Contractor shall inspect materials and equipment upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. The Contractor shall store products to allow for inspection and measurement of quantity or counting of units. The Contractor shall store materials in a manner that will not endanger the Project structure. The Contractor shall store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation. The Contractor shall comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

4. The Contractor shall not unreasonably encumber the site with materials or equipment during the performance of its work. Only materials and equipment which are to be used directly in the performance of the Contractor's work shall be brought to and stored on the premises of the School District. After equipment is no longer required for its work, the Contractor shall promptly remove such equipment from the premises of the School District. The Contractor shall be solely responsible for the protection of construction materials and equipment stored on the premises from weather, theft, damage and all other adversity. The Contractor shall at all times provide the proper housekeeping to minimize potential fire hazards, and shall provide approved spark arresters on all steam engines, internal combustion engines and flues.

5. A construction entrance will be designated for deliveries. A separate entrance will be established for entering and exiting the site only. 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 any 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.

6. The Contractor for General Construction shall provide necessary and required security measures to adequately safeguard the construction site from vandalism and intrusion of unauthorized persons. The Contractor for General Construction shall submit its means and methods of security to the Construction Manager for review and comment. The project site(s) 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 Contractor for General Construction 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 Contractor for General Construction. 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.

G. The Contractor's right to entry and use of the School District premises arises solely from the permission granted by the Owner pursuant to the agreement between the Contractor and the Owner. This permission shall be deemed to be withdrawn upon the termination of the Contractor's agreement with the Owner.

H. 1. The Contractor shall be required to perform its work with no interruption to the School District's operations, including its administrative and business operations. Any work which will interfere with the School District's operations and/or which is to be performed when the School District's facilities are in operation shall be performed on evenings and weekends. Additionally, the Contractor shall conduct its work in compliance with federal, state, county or local ordinances. All costs incurred by the Owner to make the facilities available during evening and weekends shall be borne by the Contractor. The Owner reserves the right to determine what work will "interfere" with its operations and said determination shall be final.

2. The Contractor may request access to the site during times beyond the work hours permitted. Approval is solely at the discretion of the Owner. If approval is given, the Contractor is responsible for paying all additional costs incurred by the Owner, Architect and the Construction Manager for providing the site to the Contractor during the additional time periods.

3. 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.

4. The Owner shall not be responsible for any overtime charges incurred by the Contractor during the course of this project. Any and all costs associated with work which is performed at hours requiring the payment of such overtime by the Contractor to its workers shall be the Contractor's responsibility.

I. 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 occupies or acoustical abatement measures shall be taken.

J. The Contractor shall provide all required temporary access walkways, both interior and exterior, and the like necessary to complete its work. The Contractor shall maintain an unobstructed condition at all entrances and/or exits from present buildings. No equipment, other than equipment with rubber tires, will be allowed on any existing or new pavement, UNLESS THE CONTRACTOR HAS OBTAINED THE PRIOR APPROVAL OF THE CONSTRUCTION MANAGER AND THE PAVEMENT HAS BEEN FIRST PROTECTED WITH PLANKING OR BY OTHER MEANS APPROVED BY THE CONSTRUCTION MANAGER.

K. The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the premises of the School District without the prior written consent of the Owner, which may be withheld at the sole discretion of the Owner.

L. 1. Without the prior approval of the Owner, the Contractor shall not permit any workers to use any existing School District facilities, including, without limitation, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Employees, vehicles, and equipment of the Contractor and of all others engaged by the Contractor for the performance of its work shall enter onto the premises of the School District for which construction work is to be performed only at those locations designated or approved by the Construction Manager. The parking for construction personnel shall be limited to the designated trailer park area only. Failure to abide by this rule will result in towing of cars at the expense of the contractor who employs the individual.

2. The Contractor shall ensure that its work, at all times, is performed in a manner that affords reasonable access to both vehicles and individuals, to the premises of the School District and all adjacent areas. The Contractors' work shall be performed, to the

fullest extent possible, in such a manner that areas in and around the construction area shall be free from all debris, building materials and equipment likely to cause hazardous conditions, and do not close or obstruct walkways, roadways or other occupied facilities or facilities to be used by the Owner. Without limitation to any other provision of the agreement between the Contractor and the Owner, the Contractor shall use its best efforts to minimize any interference with the occupancy of areas, buildings, entrances, and parking areas in and around the premises at which work is being performed. Free access to fire hydrants and standpipe connections shall be maintained at all times during construction operations, and portable fire extinguishers shall be provided by the Contractor and made conveniently available throughout the construction site.

3. The Construction Manager, in conjunction with the Owner and the Architect, shall designate locations at the site at which the Contractor, its subcontractors and employees may utilize in connection with its work. The Contractor's employees and the employees of the Contractor's Subcontractors and others engaged by the Contractor to perform its work are prohibited from trespassing or leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's Subcontractors and others engaged by the Contractor to perform its work are prohibited from leaving any vehicle on any property not assigned by the Owner as set aside for the use of the Contractor. The Contractor's employees and the employees of the Contractor's Subcontractors and other engaged by the Contractor to perform its work are restricted to the immediate area at which work is to be performed. Only persons having official business will be admitted to the construction site. NO COMMUNICATION BETWEEN THE CONTRACTOR, ITS EMPLOYEES, SUBCONTRACTORS' EMPLOYEES, OR OTHERS ENGAGED BY THE CONTRACTOR FOR THE PERFORMANCE OF ITS WORK AND STUDENTS OR STAFF WILL BE PERMITTED.

4. The Contractor, its employees, its Subcontractors and their employees or agents, and all others engaged by the Contractor in connection with the performance of its work are required to wear photographic identification badges at all times. The Contractor shall provide such individuals with said photographic identification badges. These badges shall be worn so as to be readily and easily visible. All workers and representatives of the Contractor, its subcontractors or suppliers shall wear these badges while on school property. The information on these badges shall be as prescribed by the Owner and the Construction Manager. Each person seen without a photo identification badge (or otherwise failing to comply with this requirement in the opinion of the Owner or the Construction Manager) shall be ordered to leave school property. No warnings shall be necessary. The Contractor(s) and their subcontractor(s) employing the offending person(s) shall be solely responsible for making-up and paying for any loss of production or required progress in the Work resulting from this action (including any claims by other Contractors dependent on the work of this Contractor). All parties agree that any action taken to enforce this requirement shall not be construed by any Contractor or its subcontractors or suppliers as the basis for a claim (for either time or money) for delay to the Work or to the Contractor,

its Subcontractors, or Suppliers.

5. Without limitation of any other provision of the agreement between the Owner and Contractor, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the premises of the School District. The Contractor shall immediately notify the Owner in writing if during the performance of its work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such compliance and suggesting alternative through which the same results intended by such portion of the rules and regulations can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirements of the rules and regulations.

M. No drinking of alcoholic beverages, smoking or use of controlled substances is permitted on the grounds. The Contractor shall insure that none of its or its Subcontractors, its employees, agents, and/or consultants report to the site impaired by alcohol or controlled substances. The Contractor bears the responsibility of determining if its, or its subcontractors, employees are in any way impaired and whether the safety of the public, the employees of other Contractors and their Subcontractors, the Owner, Architect, or Construction Manager are jeopardized. Each contractor shall provide drinking water for its own employees.

N. The Contractor's employees, representatives, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to refrain from using indecent language. All doing so will be removed from the site. Artwork or decoration found on vehicles belonging to Contractor or Subcontractor employees parked on or near the school property which contain indecent language or pictures shall either be covered or removed from the location.

O. The Contractor's employees, representative, agents and consultants, and all of its Subcontractors' employees, representatives, agents and consultants at the site are to wear shirts, long pants and proper footwear.

P. Each contractor shall keep the premises and surrounding area in which it is working free from accumulation of waste materials or rubbish caused by the performance of all of the work being performed on-site and in the buildings. On a daily basis at the conclusion of work on the project, each 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. Each Contractor shall broom sweep all construction areas in which it has performed worked every day. The Construction Manager shall perform an inspection each afternoon to determine that the work areas of the contractors have been properly cleaned. In the event the work areas are not cleaned, the Construction Manager shall advise the offending contractor to provide cleaning as required herein. If any contractor fails to keep the site safe and clean within four (4) hours of being notified by the Construction

Manager, either verbally or in writing, the Construction Manager will have the cleanup work performed and back charged to the offending contractor without further notification to the Contractor. The cost of such cleaning company, together with the cost of any custodial costs of the School District, at prevailing overtime rates plus 15% will be charged to the offending contractor. Notice to field personnel shall be deemed notice to the Contractor.

Q. The Contractor shall provide ventilation of enclosed areas during construction as may be required to permit proper curing and drying out and to prevent excessive humidity, moisture and condensation. Ventilation shall be by natural or artificial means as required by conditions involved.

R. The Contractor shall be responsible for the control of chemical fumes, gases and other contaminates produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure that they do not enter occupied portions of the building or air intakes.

S. The Contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers' recommendations before a space can be occupied.

T. From the commencement to the completion of the Project, the Contractor shall keep the parts of the work and the buildings free from accumulation of water no matter what the source or cause of water.

U. 1. The General Contractor shall construct temporary partitions where shown on drawings or where otherwise required for safety of the public or to prevent dust from entering occupied areas. Partitions shall be dust-proof from floor to slab or structure above (if existing condition is a drop in tile ceiling, Contractor shall remove tile and install partition to structure above). In addition to framing and sheetrock, the Contractor shall install fire resistant plastic partitions on the work area side of its work. If an access door is required, an alternating 3 layer plastic system shall be used. The door shall be a standard hollow metal door with lockset and closer. Keys shall be distributed to the Owner's other contractors, the Owner and the Architect.

2. Where a contractor other than the General Contractor is the only contractor scheduled to perform work in a particular area of the site at any given time, the responsibilities allocated to the General Contractor in subdivision 1 of this paragraph U shall be performed by such other contractor.

3. All cutting and welding performed within an occupied building or adjacent to a window or intake vent shall be performed during off hours.

V. 1. The Contractor shall control the safe handling and storage of all welding

materials, acetylene and oxygen tanks, and other equipment required for welding and cutting work at the job site. Such storage shall be in compliance with OSHA regulations.

2. Welding materials and equipment shall be removed promptly from the premises upon completion of the welding and cutting work.

W. The Contractor shall be responsible for all costs incurred by the Owner caused by false security/fire alarms set off by the Contractor. Costs shall include custodial response charges etc.

X. The Contractor shall be responsible for broken glass, and at the completion of the Work shall replace such damaged or broken glass. After damaged or broken glass has been replaced, the Contractor shall remove all labels, wash and polish both sides of all glass. In addition to general broom cleaning, the General Contractor shall perform the following final cleaning for all trades at completion of the Work:

1. Remove temporary protections;
2. Remove marks, stains, fingerprints and other soil or dirt from painted, decorated and natural finished woodwork and other Work;
3. Remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;
4. Clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;
5. Clean aluminum in accordance with recommendations of the manufacturer; and
6. Clean all floors thoroughly in accordance with recommendations of the manufacturer.

ARTICLE 5
SUBCONTRACTORS

A. 1. As soon as practicable after receipt of Letter of Intent to Award, Notice to Proceed or other form of official notice of award of the Contract, but not more than ten (10) days after receipt of official notice of award of the Contract, the Contractor shall furnish the Owner and the Architect, in writing, with (1) the name, trade and subcontract amount for each Subcontractor and (2) the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. Copies of all Subcontractor contracts, fully executed, are to be provided to the Construction Manager, including but not limited to all addenda, appendices, and/or exhibits including scope of work sheets. All such subcontracts shall be submitted to the Construction Manager within ten (10) days of the Owner's award of the contract to the Contractor.

2. Upon review of the Contractor's list of Subcontractors, the Architect will advise the Contractor in writing stating whether or not the Owner, the Construction Manager or the Architect, after due investigation, accepts or rejects, any proposed Subcontractor. Subcontractors will not be acceptable unless, when requested by the Architect, evidence is furnished that the proposed subcontractor has satisfactorily completed similar subcontracts as contemplated under this prime contract, and has the necessary experience, personnel, equipment, plant, and financial ability to complete the subcontract in accordance with the intent to the Documents. As verification of financial ability, the Owner reserves the right to request and receive up to five (5) years worth of financial statements, bank references, bond/insurance company references and all other information required to assess financial ability.

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 sub-contractor 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 in work of similar nature. Upon receipt of a rejection of a subcontractor by the Owner, Construction Manager or 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 subcontractor is qualified to perform the work. Upon review of such reasons, the Owner, Construction Manager or Architect shall re-consider its determination and shall advise the Contractor of its determination upon such review. If the Owner, Construction Manager or Architect still finds that such subcontractor does not meet the requirements above-stated, it shall advise the Contractor. The Owner, Construction Manager or Architect's determination upon such review shall be final and binding on the Contractor and its Subcontractor and the Contractor hereby waives any and all claims it or its 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.

4. The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such change.

B. By appropriate agreement, the Contractor shall require each Subcontractor to be bound to the Contractor by terms of the Contractor's agreement with the Owner, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by said agreement, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contractor's agreement with the Owner so that subcontracting thereof will not prejudice such rights, and shall allow 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 its agreement with the Owner, has against the Owner. However, the Subcontract agreement between the Contractor and Subcontractor shall not provide, nor shall this Agreement be deemed to provide any rights, remedies or redress by the Subcontractor(s) against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors.

C. The Contractor shall promptly notify the Owner, Construction Manager and Architect of any material defaults by any Subcontractors and/or whether it has terminated its agreement with any of its subcontractors for any reason.

D. The Contractor hereby assigns all of its rights in its agreements with its Subcontractor(s) and hereby does assign, transfer and set over to the Owner all of its rights and/or interests in its agreements with its Subcontractor(s), but only in the event of termination of the Contractor's agreement with the Owner pursuant to Article 17, paragraph A of these General Conditions of the Contract for Construction and only to the extent the Owner implements its rights to take such assignment of contract by notifying the Subcontractor in writing of its intention to do so. Such an assignment is subject to the prior rights of the surety, if any, obligated to the Owner pursuant to a performance bond submitted in connection with the Contractor's work.

E. If the Work in connection with a subcontract has been suspended for more than ninety (90) days after termination of the Contract by the Owner and the Owner accepts assignment of such subcontract, the Subcontractor's compensation shall not be adjusted for any increase in direct costs incurred by such Subcontractor as a result of the suspension.

F. It shall be the Contractor's responsibility, when sub-contracting any portion of his work, to arrange or group items of work under particular trades to conform with then prevailing customs of the trade, regardless of the particular Divisions and Sections of the Specifications in which the work is described.

G. All subcontracts must be in writing.

ARTICLE 6
CONTRACTOR'S USE OF DRAWINGS/SPECIFICATIONS

A. The Agreement between the Owner and Contractor, and all documents incorporated therein by reference, including but not limited to, the drawings and project manual shall be signed by the Contractor and the Owner.

B. The intent of the agreement between the Owner and the Contractor is to include all items necessary for the proper execution and completion of the work to be performed by the Contractor. The documents comprising the agreement between the Contractor and the Owner are complementary, and what is required by one shall be as binding as if required by all.

C. 1. In the event of inconsistencies within or between parts of the agreement between the Contractor and the Owner or between the agreement between the Contractor and the Owner and applicable standards, codes and ordinances, the Contractor shall (a) provide the better quality or greater quantity of Work or (b) comply with the more stringent requirement; either or both in accordance with the Architect's interpretation.

2. On the Drawings, given dimensions shall take precedence over scaled measurements and large scale drawings over small scale drawings.

3. Before ordering any materials or performing any of its work, the Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the performance of the work.

4. 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.

5. Drawings, in general, are made to scale, but all working dimensions shall be taken from the figured dimensions or by actual measurements at the job and in no case by scaling. The Contractor shall study and compare all Drawings and verify all figures before laying out or constructing the work and shall be responsible for any and all errors in his work which might have been avoided thereby. Whether or not an error is believed to exist, deviation from the Drawings and the dimensions given thereon shall be made only after approval in writing is obtained from the Architect.

6. In the event addendum (a) are issued and contain changes to the Drawings and/or Specifications, the provisions in the addendum (a) supersede previously issued Drawings and/or Specifications.

D. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control Contractor in dividing the work among Subcontractor or in establishing the extent of Work to be performed by any trade.

E. Unless otherwise stated in the agreement, words and abbreviations which have well-known technical or construction industry meanings are used in the agreements in accordance with such recognized meanings.

F. 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 General Contractor (if any), the Plumbing Contractor, the Heating, Ventilation, Air Conditioning Contractor, Electrical Contractor and other specialized trades, 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.

G. All indications or notations on the drawings which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the drawings or project manual. All work mentioned or indicated in the drawings or project manual shall be performed by the Contractor unless it is specifically indicated therein that the work is to be performed by others.

H. The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's service through which the Contractor's work is to be performed. The Contractor may retain one contract record set during the course of the project. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work.

I. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects without the specific written consent of the Owner and Architect. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the performance of its work pursuant to its agreement with the Owner. All copies made under this license shall bear the statutory copyright notice, if any, shown on 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 this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

J. The Owner shall furnish surveys describing physical characteristics of the site, upon written request of the Contractor and to the extent such survey is in existence at the time of said request, legal limitations and utility locations for the project sites. Nothing herein shall be construed as requiring the Owner to generate any document which it does not possess at the time of the request by the Contractor. In the event that the survey provided does not clearly delineate the metes and bounds of the Owner's property, the Contractor shall stop work and immediately notify the Architect, Construction Manager and the Owner. The

Contractor shall NOT proceed with its work until it receives written permission from the Construction Manager and/or the Architect. The Contractor shall be fully responsible for all costs arising from non-compliance with this provision. Any delays associated with this provision shall not serve as a basis for a claim by the Contractor.

K. From the basic data established by the Owner, the General Contractor shall establish reference control points and complete the layout of the work. Each Contractor is responsible for utility markouts as it pertains to the scope of their work and maintain markout during work. Sketch of layout with reference points to be given to Construction Manager and Architect at the time of markout.

L. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the specifications, shown on the drawings, or as the same may be modified at the direction of the Architect to meet changed conditions.

M. The General Contractor shall be responsible for the establishment of points, wall and partition lines required by the various Prime Contractors and subcontractors in laying out their work.

N. Each Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the work from the base lines and bench marks established by the Owner.

O. 1. The General Construction Contractor shall establish a baseline and benchmark system for each building addition, area of renovation or component using the services of a licensed professional surveyor. The surveyor(s) employed to establish this system or to extend and maintain an existing benchmark system for the work of other trades shall have not less than five years experience in performing construction surveys similar to the work they will perform for this project. The remaining Contractors and their respective subcontractors shall be responsible for extending these lines, levels and grades, and for performing all layout for their own work. The Contractor is solely responsible for any damage or loss due to incorrect extension of lines, level or grades in their layout. The Contractor and its subcontractors shall be responsible for the accuracy with respect to the layout of their work. Any discrepancies or errors in the drawings, perceived by another contractor or subcontractor shall be immediately reported to the Construction Manager. If any corrections are necessary, they shall be executed in accordance with the terms and provisions of these General Conditions.

2. The Contractor and its subcontractors shall be responsible to offset or to protect their markings from anything that may disturb them.

3. Every contractor shall work off the lines and elevations established and maintained as the baseline and benchmark system.

4. Each Contractor is responsible for the accuracy of his own work.

P. The Architect may require that construction 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.

Q. Except for the basic building permit, the Contractor shall be responsible for securing and maintaining for the life of the project: all permits, P.E. Licenses, connection fees, inspections, etc. applicable to, or customarily secured for the work. This provision includes any permits to be issued in the name of the Contractor required for the work. Originals of all permits are to be issued in the name of the Contractor as required for the work. 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.

R. 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 Architect at once.

S. The exactness of grades, elevations, dimensions, or locations given on any Drawings issued by the Architect, or the work installed by other contracts, is not guaranteed by the Architect or the Owner. The Contractor shall, therefore, satisfy itself as to the accuracy of all grades, elevations, dimensions, utilities and locations. In all cases of interconnection of its Work with existing or other work, it 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, locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.

T. 1. The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define its work in greater detail, or to permit the proper progress of its work. To the extent the Architect advises the Contractor that the existing design drawings, specifications and/or instructions given are sufficiently detailed for the Contractor to perform its work, the Architect shall be under no obligation to further clarify or define the work to be performed. In all other circumstances, the Architect shall issue a field order which responds to the request for information.

2. Requests for Information (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.

U. The Contractor shall, prior to the start of any portion of the Work:

1. review any specified construction or installation procedures, including those as may be recommended by the proposed manufacturer.

2. advise the Architect if the specified procedure(s) deviates from good construction practice.

3. advise the Architect if following said procedure(s) will affect any warranty, including the contractor's general warranty.

4. advise the Architect of any objections the Contractor may have to the specified procedure(s).

5. propose any alternative procedure(s) which the Contractor will warrant.

V. 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 Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

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 contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

3. With respect to sitework materials, all products submitted for use and incorporated into this project shall be on the Approved List of Materials and Equipment published by the NYSDOT Materials Bureau, most recent edition.

4. All products submitted for use and incorporated into this project shall be asbestos free.

W. 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, they shall indicate in writing, and prior to award of 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 substitutions as set forth in Article 6.X below.

X. 1. 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:

a. For which specified material or equipment the request for substitution is being made;

b. What kind, type, brand, or manufacturer is sought to be substituted for the specified items;

c. 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. Additionally, the Contractor shall 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.

d. 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.

e. Samples, where applicable or requested.

f. 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.

2. By making said requests in conformance with procedures established herein and elsewhere in the Project Manual, the Contractor:

a. 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.

b. Represents that the warranty for the substitution will be the same, or greater than, that applicable to the specified product.

c. Certifies that the cost data is complete and includes all related costs under this contract, including professional services necessary and/or required for the architect and engineers to implement said substitution and waives any and all claims for additional costs related to the substitution which subsequently become apparent.

d. 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.

e. 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 construction schedule.

3. Proposals for substitutions shall be submitted in triplicate to the Architect in sufficient time to allow the Architect no less than fourteen (14) working days of award of contract for review.

4. No substitutions will be considered or allowed without the Contractor's submittal of complete substantiating data and information as stated hereinbefore.

5. All proposed substitutions shall be submitted to the Architect within fourteen (14) working days of the award of the contract to the Contractor. *(This provision 6(X)(5) shall not apply to equivalents.)*

Y. 1. Submittal of shop drawings, product data, material safety data sheets, samples or similar submittals shall be in accordance with the provisions of the project manual.

2. The Contractor represents and warrants that all shop drawings have been prepared by persons and entities possessing expertise and experience in the trade for which the shop drawing is prepared and, if required by the Architect or applicable law, by a licensed engineer, job specific, reviewed by Contractor and stamped by the Contractor.

3. If the Contractor elects to perform its work without approvals, such work shall be at the Contractor's own risk and expense.

4. By approving and submitting shop drawings, product data, samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of its work.

5. The Contractor shall not be relieved of responsibility for deviations from requirements of its work by the Architect's approval of shop drawings, product data, samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors and/or omissions in the shop drawings, product data, samples or other of its submittals to the Architect, by the Architect's approval thereof.

6. The Architect shall review, approve, reject or take other appropriate action respecting submittals made by the Contractor as set forth in the Project Manual. The Architect shall check for conformance with information given in the drawings and project manual and the design concept expressed in the agreement between the Owner and the Contractor. Review of such submittals 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 designed by the Contractor, all of which remain the responsibility of the Contractor. Further, the Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of 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. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon such certification to establish that the materials, systems or equipment will meet the performance criteria required by the Contract Documents.

7. Upon the Architect's rejection of the Contractor's shop drawings, product data, samples and/or other documentation submitted by the Contractor to the Architect, the Contractor shall review the rejection and re-submit such shop drawing, product data, sample and or other document in accordance with the Architect's instruction. The Contractor shall direct the Architect's specific attention in writing or on re-submitted shop drawings, product data, samples, or similar submittals, to revision which have been made, including revisions not specifically requested by the Architect. 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.

8. When professional certification of performance criteria of materials, systems or equipment is required of the Contractor, the Architect shall be entitled to rely in a reasonable and professional fashion upon the accuracy and completeness of such calculations and certifications provided, however, if the Architect, in its reasonable and professional judgment considers it advisable, the Architect shall verify the accuracy and completeness of any and all such calculations and/or certifications. In the event any and all such calculations and/or certifications are found to be inaccurate and/or incomplete by the Architect, the Contractor shall assume full responsibility and bear all costs attributable or related thereto, including, without limitation, the expense of the Architect's additional services associated with the verification of such calculations and/or certifications and the expense of the Architect's additional service made necessary by the failure of such calculations and/or certifications to be accurate or complete.

9. 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 as set forth in the Project Manual.

Z. The Architect will interpret and decide matters concerning performance under and requirements of the drawings and/or technical specifications on written request of the Contractor. Such interpretations may, at the Architect's option, be issued in the form of additional drawings or instructions indicating in greater detail the construction or design of the various parts of the Contractor's work. Such drawings or instructions may be forwarded by the Architect to the Contractor by field order, construction change directive or other notice to the Contractor. The Contractor shall execute the work for which it requested an interpretation in accordance with such additional drawings or instructions

without additional cost or extension of its contract time. After a decision has been rendered by the Architect on a matter for which the Contractor sought the Architect's interpretation of the drawings and/or technical specifications, the Contractor shall proceed with the work as directed by the Architect. Failure to proceed with the work in accordance with the Architect's interpretation may be used as a basis for termination of the Contractor's contract pursuant to Article 17 of these General Conditions.

AA. The Contractor shall maintain at the site one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and the Construction Manager and shall be delivered to the Construction Manager for submittal to the Owner upon the completion of its work.

BB. 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 and/or structural changes in the design; and (vi) such other information as either Owner or Architect may reasonably request. At the completion of the work, Contractor shall transfer all information on record drawings to reproducible drawings with new information clouded and noted. Such drawings shall be stamped with the Contractor's name and "AS-BUILT" in the lower right hand corner. The colored record drawing and the as-built reproducible drawing 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/or As Built drawings receive the approval from the Architect and the Owner (and all other closeout requirements are met).

CC. The Contractor shall maintain all approved permit drawings in a manner so as to make them accessible to government inspectors and other authorized agencies. All approved drawings shall be wrapped, marked and delivered to the Owner within sixty (60) days of final completion of the Contractor's work.

DD. Each Prime Contractor shall be furnished, free of charge, 3 copies of the Contract Documents and Project Manuals, including all Addenda. Any and all additional copies will be furnished to the Contractor at the cost of reproduction, postage and handling.

ARTICLE 7
CONTRACTOR'S SAFETY/SECURITY PROGRAM

A. 1. The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of its work. 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. Each contractor is required to submit their 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.

2. Effective July 1, 2008, 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 ten (10) hours in duration.

The Contractor and its subcontractors shall conduct their operation in accordance with the Safety Guides for Construction as issued by the SED, and, the Contractors' Safety Program.

3. All safety equipment including hard hats and weather protective gear required for the Contractor to perform its work are to be supplied by the Contractor and/or its subcontractors. Within the designated construction areas, the Contractor's employees, superintendents, and/or other agents, and its subcontractors, employees, superintendents, and/or other agents are required to wear hard hats and other required and/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 or Construction Manager and 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.

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.

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 Prime Contractor, at its own expense, must make corrections within two (2) working days of receiving a written report.

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.

B. 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.

C. The Contractor and each of its subcontractors shall conduct its/their operation in accordance with all applicable laws, regulations and order of local, state and federal governments. The Contractor agrees, in order that the work will be completed with the greatest degree of safety to conform to the requirements of the Occupational Safety and Health Act of 1970 (OSHA) and the Construction Safety Act of 1969, including all standards

and regulations that have been since or shall be promulgated by the governmental authorities which administer such acts.

D. The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

E. The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for surety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

F. The Contractor shall take reasonable precautions for the safety and protection of employees at the project site and other person who may be affected by its work, including but not limited to students, staff, employees and agents of the Owner, the Construction Manager and the Architect.

G. The Contractor shall protect and secure its work and the materials and/or equipment to be utilized in connection with its work, whether stored on or off the site and whether in its care, custody and control or that of its Subcontractors, subcontractors to its subcontractors, or material suppliers.

H. The Contractor shall take all steps necessary to protect all property at or adjacent to the site, including but not limited to trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

I. All delivery vehicles/trucks/machinery/etc. permitted on the site must be equipped with back-up alarms and enter through the designated access points. The Contractor's failure to demonstrate this ability will result in cancellation of delivery or stoppage of work. All delays associated with this cancellation will be the responsibility of the contractor responsible for the work involved.

J. All crane picks, materials delivery, etc. must be coordinated so as not to lift over any occupied area of the building. If absolutely necessary, this work shall be done on off hours to insure the safety of the building occupants. Crane location must approved by the Construction Manager to insure the safety of building occupants.

K. The Owner or Construction Manager reserves the right to have all hoisting equipment periodically inspected by an independent inspector whose findings will be binding. The Contractor, at its own expense, must make corrections cited by the inspector before continuing work. The Owner or Construction Manager will not assume any responsibility for the safe operation of any hoisting equipment by exercising this right. The Contractor and/or its subcontractor(s) shall cooperate with the inspector by allowing time

for the inspection. The Contractor shall be notified twenty four (24) hours prior to the time of the inspection. These inspections do not release the Contractor if its responsibility to provide all engineering, permits and inspections as required by OSHA or the New York State Education Department prior to use of any hoisting equipment.

L. The Construction Manager, the Owner, and/or the Architect will not assume any responsibility for the safe operation of any cranes or equipment by exercising this right. The Contractor and its subcontractors shall cooperate with the inspector by allowing time for inspection. The Contractor will be notified 24 hours prior to the time of the actual inspection. The Contractor is obligated to perform all engineering, obtain permits, and to have all hoisting equipment inspected as required by OSHA, Village, Town, County, State, and Federal regulations as well as any other agency having jurisdiction. Copies of all inspection reports and certificates must be transmitted to Construction Manager as soon as possible.

M. The Contractor shall use the entrances designated on the site logistic plans and drawings for personal vehicles, trucks, equipment, deliveries and the like.

N. All interior temporary partitions and emergency egress barriers (if required) are to be installed on an after hours basis (weekends/school holidays).

O. 1. When use or storage of hazardous materials or equipment or unusual construction methods are necessary to perform its Work, the Contractor shall obtain the Owner and the Construction Manager's consent for the use of such materials, equipment or unusual construction methods. In the event the Owner determines that the use of such hazardous material or equipment or unusual construction methods can be performed by the Contractor with alternative means, methods and/or techniques, the Contractor shall employ such alternate means of prosecuting its work at no additional cost to the Owner.

2. In the event the Owner approves the use or storage of such hazardous materials, equipment or unusual construction methods, the Contractor shall provide for the Owner's and the Construction Manager's use a full set of safety instructions relating to all such materials. Additionally, when the Owner and/or the Construction Manager reviews the use of storage of such hazardous materials, equipment and or unusual construction methods, the Contractor shall exercise the highest degree of care and carry on such activities under supervision of properly qualified personnel.

3. Transportation, storage, and use of explosives shall be in strict accordance with all local, state and federal regulations, statutes, and requirements. All safety precautions as set forth in the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, Inc. shall be observed.

4. The Contractor is responsible for its own storage and personnel trailers at the site. The Contractor will be required to supply man trailers and storage box trailers as

required. All costs related to delivery, construction, protection, power, etc. for said trailers is the responsibility of the contractor utilizing the space. The Owner WILL NOT PROVIDE STORAGE SPACE. The placement of personnel and/or storage trailer will be strictly limited to pre-determined locations. The Contractor shall obtain the written approval of the placement of any trailer or storage box from the Construction Manager.

P. During construction, the General Contractor shall be responsible for maintaining a watertight structure. This shall include additions and 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, contractor shall be responsible for all costs associated with clean up and repairs. Inasmuch as flooding and damage have safety implications to the general public, clean up and repairs may be made by the Owner without warning to the Contractor. Administration costs incurred by the Owner and Architect will also be back charged to the Contractor. The Contractor, by entering into contract with the Owner agrees to be liable for these costs.

Q. When all or a portion of the Contractor's work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the work, as necessary, from injury by any cause.

R. 1. The Contractor shall promptly remedy damage and loss to all property of the Owner, or adjacent to the Owner's property (other than damage or loss covered by insurance) 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, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor.

S. Title to all completed or partially completed work at the job site, and to all materials delivered to and stored at said job site which are intended to become a part of the completed work covered by the agreement between the Contractor and the Owner, shall be in the name of the Owner. Notwithstanding the foregoing, and prior to acceptance of the completed work by the Owner, the Contractor shall be liable for all loss of or damage to said completed work, partially completed work, materials furnished by the Contractor, and/or materials or equipment furnished by others, the custody of which has been given to the Contractor, arising from any cause other than those against which the Owner herein undertakes to carry insurance. In the event of loss or damage from cause other than those against which the Owner undertakes to carry insurance, the Contractor shall replace or repair the said work or materials at his own cost and expense, to the complete satisfaction of the Owner, the Construction Manager and the Architect.

T. The Contractor shall promptly report in writing to the Owner, the Architect and the Construction Manager all accidents arising out of or in connection with the Work which cause death, person injury, or property damage, giving full details and statements or 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 the Architect.

U. 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.

V. Any and all fines or citations levied against the Owner, Architect, or Construction Manager due to the failure of the Contractor to comply with regulations of any governing authority, shall be paid for by the Contractor. This shall include any interest or late charges which accrue due to the Contractor's failure to remit payment upon receipt of such levies.

W. The Contractor shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly or indirectly employed by such Contractor, with respect to violations of OSHA requirements, rules and/or regulations.

X. The Contractor acknowledges that the Labor Law of the State of New York, and regulations adopted thereunder, place upon both the Owner and Contractor certain duties and that liability for failure to comply therewith is imposed on both the Owner and Contractor regardless of their respective fault. The Contractor hereby agrees that, as between the Owner and the Contractor, and to the extent permitted by law, the Contractor is solely responsible for compliance with all such laws and regulations imposed for the protection of persons performing the Contract.

Y. The Contractor shall indemnify and hold harmless the Owner, Architect, and Construction Manager, 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 to refuse to defend any such action, the Contractor shall be liable to the Owner for all costs of the Owner, Architect or Construction Manager in defending such claim or action and all costs of the Owner, including attorney's fees, in recovering such defense costs from the Contractor.

Z. The Contractor and its subcontractors shall indemnify and hold harmless the Owner, Construction Manager and Architect from any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any subcontractor or any person or firm directly or indirectly employed by such Contractor, for the act and/or omissions of any Contractor or Subcontractor that resulted in an incident and/or accident causing personal injury and/or property damage.

ARTICLE 8
CHANGES IN THE WORK

A. Without invalidating the agreement between the Owner and the Contractor, and without notice to the Contractor's surety, the Owner may, at any time or from time to time, order additions, deletions or revisions in the Contractor's work. Such additions, deletions or revisions will be authorized by field order, change order, or construction change directive.

B. Field Orders are an interpretation of the contract drawings and/or specifications which order minor changes in the Contractor's work which will not result in an increase or decrease in the Contractor's total 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 time of the Contractor's time to complete its work. Hence, the Contractor shall perform the work included in field orders so as to cause no delay to its work and/or the work of other 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.

C. 1. 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 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 subcontractor(s) of subcontractor(s) perform in connection with additional work shall be submitted using the following format and in no event shall the total for overhead and profit on any change order exceed fifteen percent (15%) of the cost of the work.

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.	Sub-Contract Work (include itemized breakdown.	

	Sub-Contractor(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)	

2. All proposals submitted by the Contractor without the itemization indicated herein will be returned to the Contractor for re-submission by the Contractor. For any work performed by the Contractor's own forces, fifteen percent (15%) for overhead and profit will be allowed for labor and material related costs. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall any change order proposal exceed fifteen percent (15%) of the cost of overhead and profit.

The Contractor shall not be entitled to recover overhead and profit on the rental value of equipment and machinery. "Equipment and machinery" shall not include (1) tools customarily used by the contractor's trade, including but not limited to hand tools, and/or (2) equipment and machinery already on site and being utilized by the Contractor for the original scope of work.

The Contractor shall submit with its change order proposals actual invoices from its insurance broker reflecting actual additional costs associated with the procurement of bonds.

3. The Contractor's subcontractor's proposal for any work it is to perform in connection with the additional work shall only include ten percent (10%) for the subcontractor's overhead and profit including sub-subcontracted work. The Contractor is entitled to five percent (5%) on work performed by its subcontractor in accordance with paragraph C (1) of this Article 8. Costs to which overhead is to be applied shall be limited to cost of labor and materials including the cost of delivery. Under no circumstances shall the Contractor or the Contractor's subcontractor(s) be entitled to be reimbursed for overtime, except when specifically approved by the Owner in writing and not as an Extraordinary Measure as set forth in Article 13, and in such event the Contractor shall be paid for by the Owner on the basis of premium payment.

4. Notwithstanding the foregoing, work which is performed pursuant to an allowance included in the Contractor's base contract, the provisions of Article 9, paragraph B, concerning itemization of such work shall be controlling.

5. a. A change in the Contract Sum shall be accomplished only by a written Change Order. Accordingly, no course of conduct or dealings between the parties, nor express or implied acceptance of alterations or additions to the Work, whether or not there is, in fact, any unjust enrichment to the Work, shall be the basis of any claim as defined in Article 18 of these General Conditions 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.**

b. 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.

2. Copies of invoices from subcontractors supplying work in connection with the change order work.

D. 1. When the Owner or Architect request that portions of the Contractor's work originally included in the contract drawings or specifications be deleted and which will result in a reduction of the Contractor's original contract sum, the Architect shall request that the Contractor submit its proposal for deleting the scope of such work from its 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 Article 8, paragraph C(1) of these General Conditions of the Contract for Construction or the schedule of values, whichever is greater. The Contractor shall not be entitled to retain its overhead and/or 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/decrease with respect to that change.

2. The Owner may in its sole discretion deduct and/or reduce the scope of the Contractor's contract with or without any specific reasons therefor.

E. 1. In the event the Contractor and the Owner cannot agree on the sum by which its contract with the Owner is to be increased or reduced based upon changes to the scope of the work as described in Article 8, the Architect shall issue a construction change directive reflecting the deduction and/or reduction of the scope of the Contractor's contract and the Contractor will (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 this or other contractors working at the site, 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 and/or reduction of the scope 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 and/or reduction 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; (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 18 of these General Conditions. Failure to timely file any claim in accordance with requirements set forth therein shall constitute a waiver of such claim.

2. In the event the Contractor and the Owner reach agreement on the amount by which the Contractor's contract sum is to be increased or decreased based upon changes to the scope of the Contractor's work as described in Article 8, the Architect, Owner, Construction Manager and Contractor shall sign a change order reflecting such agreement. The change order shall include (a) the description of the change in the scope of the Contractor's work; (b) the amount of the adjustment to the Contractor's contract sum, if any; and (c) the length of time by which the time to complete the contract will be adjusted, if any. Agreement between the Owner and the Contractor in connection with any change order shall constitute a final settlement of all matters relating to the change in the Contractor's work as reflected in said change order, including but not limited to, all direct and indirect costs associated with such change and any and all adjustments to the Contractor's contract sum and the construction schedule. All such change orders for which the Owner and the Contractor have reached agreement shall be included as a separate line item in the Contractor's applications for payment as if originally part of the Contractor's agreement with the Owner.

F. Neither the Owner, the Construction Manager nor Architect may issue instructions to the Contractor to change the amount of the Contract, except by properly executed Change Orders. Instructions are issued by the Owner or the Construction Manager through the Architect, to the Contractor. The instructions shall not be carried out by the Contractor prior to a written order in the form of a Change Order, signed by the Owner, Architect and Contractor, authorizing a change in the Contract amount or an adjustment to the Contract Sum. No amount shall be payable by the Owner to the Contractor for performance of work without an executed Change Order.

ARTICLE 9
PAYMENTS

A. 1. Prior to commencing its work on the project and within one (1) week of receipt of a Notice to Proceed, the Contractor shall submit to the Construction Manager and the Architect, a schedule of values which includes the amount of money it has allocated in its bid price for the following items of work which are applicable to the Contractor's work.

Said schedule of values shall include each of the CSI division sections reflected in the specifications and applicable to the contract for which the Contractor has been awarded the contract, together with the requirements for bonds/insurance (based upon actual invoice amount), general conditions, meeting attendance and meeting documentation (at least two (2) percent of the contract sum), 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 allowance, where applicable.

2. Any schedule of values which 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 Contractors' future applications for payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Contractor's work.

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.

4. The Schedule of Values prepared by the Contractor must be approved by the Construction Manager and the Architect prior to the payment of any sums due the Contractor.

B. The Contractor shall include in its contract sum all allowances stated in the specifications. However, the Contractor's costs for unloading and handling at the site, overhead, profit and other expenses contemplated for the stated allowance amounts shall be included in its contract sum and not in the allowances.

C. The Contractor shall submit its applications for payment to the Construction Manager and the Architect on a periodic basis. The form to be used by the Contractor shall be AIA 702/CMa and 703/CMa approved by the Construction Manager, the Architect and the Owner for use in connection with the Contractor's work. The form shall be divided in sufficiently in the same form as the Contractor's schedule of values and shall reflect in separate line items for the work:

1. Total value of the work listing labor and material separately
2. Percentage of work completed at the time of submission of the application for payment
3. Value of the work completed at the time of submission of the application for payment
4. Percent of previous amount billed

5. Previous amount billed
6. Current percent completed;
7. Value of work completed to date
8. Percent remaining to be completed by the Contractor; and
9. Value of work remaining to be completed by the Contractor

D. 1. Payments to the Contractor shall be based upon materials and equipment delivered and suitably stored at the site and/or incorporated into the Contractor's work, together with the labor utilized by the Contractor in connection with its work. The Contractor may be paid for materials and/or equipment which has been delivered to the Owner's facilities but which, at the time of submission of its application for payment, has not yet been incorporated into the Contractor's work upon such conditions and requirements as the Owner, the Construction Manager and/or the Architect may advise the Contractor it must satisfy.

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 following circumstances:

a. the Contractor's failure to remedy defective work;
b. the filing of third party claims or reasonable evidence that there is a probability that such claims will be filed;
c. 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;
d. the Contractor's failure to make proper payments to its subcontractors or material suppliers for labor, materials and/or equipment;
e. reasonable evidence that the Contractor will not complete its work for the unpaid balance of the remaining monies on its contract;
f. damages caused to the Owner, Construction Manager, the Architect or another contractor as a result of the Contractor's performance of its work;
g. reasonable evidence that the Contractor will not complete its work in accordance with its agreement with the Owner, and/or that the remaining monies available on the Contractor's contract will not be sufficient to cover actual or liquidated damages for the anticipated delay;
h. the Contractor's failure to carry out its work in accordance with the contract drawings and/or specifications;
i. the Contractor's failure to notify the Architect of errors or inconsistencies between and among the contract drawings and specifications;
j. the Contractor's and/or its subcontractors' failure to comply with the requirements for maintaining record drawings;
k. the Architect's and/or the Construction Manager's discovery or observation of work which has been previously paid for by the Owner which is defective

and/or incomplete;

l. such other acts and/or omissions by the Contractor in connection with the performance of its work.

m. The amount requested exceeds the percent completion of work on the site.

3. After any such adjustments are made to the Contractor's application for payment, the Contractor shall submit four (4) copies of the final draft of its application for payment to the Construction Manager and Architect, which shall be accompanied by the following documentation:

a. 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 suppliers in the requested progress payment and the amount to be paid to the Contractor from such progress payment, together with similar sworn statements from all such Subcontractors and material suppliers;

b. 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.

c. Certified payroll for employees of the Contractor and employees of subcontractors performing work on the Project.

d. Copies of invoices submitted to the Contractor by its subcontractors and/or material suppliers.

e. Such other information which the Owner, Construction Manager and/or the Architect request the Contractor furnish in connection with its application for payment.

4. Upon submission of its application for payment, the Contractor represents that it is entitled to payment in the amount for which it seeks payment.

5. The Owner shall make payment to the Contractor within forty-five days of receipt of the Contractor's requisition of payment unless such requisition of payment is not in accordance with the terms of the Construction Documents.

6. Upon receipt of payment by the Owner, the Contractor shall promptly make

payment to each of its subcontractors and/or material suppliers for which it has received payment from the Owner. This provision does not obligate the Architect, the Construction Manager and/or the Owner to ensure payment to the Contractor's subcontractors and/or material suppliers.

7. a. In the event a subcontractor and/or material supplier files with the Owner a public improvement lien, the Owner shall withhold payment on previously certified applications for payment which have not yet been paid or subsequent applications for payment submitted by the Contractor an amount equal to 150% of the amount set forth in such public improvement lien. This provision is in addition to and does not supersede the indemnity provisions set forth in Article 12 of these General Conditions.

b. The Owner may release any payment withheld due to the filing of a public improvement 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 the 150% of such lien claim. The cost of the premiums for any such bond posted shall be borne solely by the Contractor. By posting a lien bond or other acceptable security, however, the Contractor shall not be relieved of its obligations pursuant to these General Conditions, including but not limited to the indemnity provisions set forth in Article 12 of these General Conditions.

E. 1. The Contractor shall not be entitled to payment for materials and/or equipment stored off the site unless previously approved in writing by the Owner, Architect, and/or the Construction Manager and upon the Contractor meeting any and all conditions which the Owner, the Architect and/or Construction Manager may impose in connection with such materials and/or equipment, including but not limited to insurance for such materials and cost of storage and transportation associated with such materials and/or equipment. No payment will be made for "commodity type" stored materials such as block, studs, sheetrock, roofing, insulation, piping, fittings, conduit work, etc.

2. In connection with materials and/or equipment stored off the project site, the Contractor must submit with its application for payment the following information:

a. Type of material must be specifically identified by the Contractor;

b. The Contractor must furnish an invoice from its supplier showing the total value of material and/or equipment being stored off site and must provide the bill of lading for such material and/or equipment;

c. The Contractor must provide a Certificate of Insurance in a form approved by the Owner for the full value of the item plus 10%.

d. The Contractor must execute a security agreement, together with an executed UCC-1 form;

e. The materials must be stored in a bonded warehouse;

f. The Contractor must furnish a bill of sale for stored material and/or equipment;

The Contractor still has liability for all materials whether paid or not until installed.

3. Any and all materials and/or equipment for which the Contractor has been paid shall be titled in the Owner upon installation by the Contractor and shall be stored in a bonded facility. For payment to be made to the Contractor, the Contractor must provide the Owner with a waiver of lien and general release from its supplier in connection with its provisions of such materials and/or equipment. Notwithstanding payment by the Owner, any and all warranties and/or guarantees required by this agreement shall not begin to run until the Contractor has completed all of its work.

4. Prior to payment by the Owner, the Contractor may be required to provide the Architect and the Construction Manager with an opportunity to visually inspect the materials and/or equipment for the purpose of determining that such materials are in fact in storage, are the materials specified for the Contractor's work and for any other purpose which the Owner, Construction Manager and/or Architect deem necessary for payment to be made to the Contractor.

F. If the Owner is entitled to reimbursement or payment from the Contractor under or pursuant to its agreement with the Owner, including but not limited to these General Conditions of the Contract for Construction, 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 Contractor's contract sum by an amount equal to that which the Owner is entitled.

G. The Contractor may not assign any monies due or to become due to it pursuant to its agreement with the Owner without the Owner's written consent. Any such assignment shall be in a form acceptable to the Owner. If the Contractor attempts to make such an assignment without such consent from the Owner, the Contractor shall nevertheless remain legally responsible for all obligations under its agreement with the Owner.

H. Progress payments and all other payments shall be made in accordance with Section 106 (b) of the General Municipal Law.

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I. At the same time the Contractor submits its insurance certificate to the Owner and the Construction Manager, it shall also submit to the Construction Manager the labor rates of each category of labor for which it and/or its subcontractors shall employ (either directly or indirectly). This information shall be itemized in the format shown below:

Contractor's Name					
Contractor's Address					
Contractor's Office Phone No.					
Contractor's Fax No.					
Contractor's Email Address					
Labor Rate Breakdown					
Worker's Title		**Journeyman**	**1.5 Rate**	**Foreman**	**1.5 Rate**
Base Hourly Rate					
Payroll Tax & Insurance:	% Per Hr.				
FICA					
Federal Unemployment					
State					
Workers Compensation					
Disability					
Other (Explanation Required)					
Subtotal					
Benefits:	$ Per Hr.				
Vacation					
Health & Welfare					
Pension					
Annuity					
401(k) Fund					
Other (Explanation Required)					
Other (Explanation Required)					
Subtotal					
Hourly Labor Rate					

ARTICLE 10
INSURANCE REQUIREMENTS

A. The Contractor, at its sole cost and expense, shall provide the Owner with the following insurance coverage whether the operations to be covered thereby are through 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. **Workers' Compensation and New York State Disability Insurance**
Statutory Workers Compensation (C-105.2 or U-26.3) and New York State 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.

Extensions	Voluntary compensation
	All states coverage employers
	Employer's liability - unlimited

2. **Commercial General Liability Insurance**
$1,000,000 per Occurrence
$2,000,000 General Aggregate on per project basis
$2,000,000 Products and Completed Operations
$1,000,000 Personal & Advertising Injury
$100,000 Fire Damage (any one fire)
$10,000.00 Medical Expenses (any one person)

3. **Owners Contractors Protective (OCP) Insurance**
$2,000,000 per occurrence, $4,000,000 aggregate with the Owner as the Named Insured and there will be no additional insureds on OCP policies.

4. **Automobile Liability**
$1,000,000.00 combined single limit per accident for all vehicles (owned, hired, borrowed or non-owned)

5. **Umbrella/Excess Insurance**
Coverage in all instances shall be on a follow-form basis or provide broader coverage than the general liability insurance and the automobile liability insurance. The insurance coverage shall apply on a per project basis.

Amount of Prime Contract	**Amount of Umbrella/Excess Insurance**
less than or equal to $5,000,000	$5,000,000
$5,000,0001 to $6,000,000	$6,000,000
$6,000,0001 to $7,000,000	$7,000,000
$7,000,0001 to $8,000,000	$8,000,000

Amount of Prime Contract	Amount of Umbrella/Excess Insurance
$8,000,0001 to $9,000,000	$9,000,000
Greater than or equal to $9,000,001	$10,000,000

6. **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. If written on a "claims-made" basis, the retroactive date must pre-date the inception of the contract or agreement. Coverage shall remain in effect for two years following the completion of the work. The testing company shall also provide proof of Workers' Compensation and NY State Disability Benefits Insurance, Commercial General Liability and Excess Liability with limits of $2,000,000 each occurrence and in the aggregate on a per project basis.

7. **Additional Insurance when the project requires the removal of asbestos, lead and/or other hazardous materials**

Asbestos/Lead Abatement/Pollution Liability Insurance
$2,000,000 per occurrence/$2,000,000 aggregate on a per project basis, 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. If a retroactive date is used, it shall pre-date the inception of the Contract. If the Contractor is using motor vehicles for transporting hazardous materials, the Contractor shall obtain and maintain pollution liability broadened coverage (ISO endorsement CA 9948 or CA 0112) as well as proof of MCS 90. Coverage shall fulfill all requirements of this Article 10 and shall extend for a period of three (3) years following acceptance by the Owner of the Certificate of Completion.

B. The coverages required pursuant to paragraph A of this Article 10 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.

C. The insurance required to be procured by the Contractor pursuant to paragraph A of this Article 10 shall be purchased from and maintained by insurance carriers licensed to do business and admitted to issue the type of insurance provided in the State of New York, with an A.M. Best rating of "A-" or better.

D. The Contractor must submit the Certificate of Insurance to the Architect or Construction Manager for the Owner's approval prior to the commencement of any work. The failure of the Owner to object to the contents of a certificate of insurance or the absence

of same shall not be deemed a waiver of any rights held by the Owner.

E. All insurance coverage to be provided by the Contractor pursuant to paragraph A of this Article 10 shall include a cancellation notice to the Owner of at least thirty days.

F. The Contractor agrees to effectuate the naming of the Owner, the Construction Manager and the Architect as additional insureds on the polices providing the insurance coverage described in paragraph A of this Article 10, except for Workers' Compensation and New York State Disability Insurance. Additionally, the insurance coverage to be provided by the Contractor pursuant to paragraph A of this Article 10 shall state that the Contractor's coverage shall be the primary and non-contributory coverage for the Owner and the Owner's Board of Education, employees and volunteers including a waiver of subrogation in favor of the Owner for all coverages including Workers' Compensation.

G. Additional insured status for 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 products and completed operations (CG 20 37 or equivalent). A completed copy of the additional insured endorsements must be attached to the Certificate(s) of Insurance that include General Liability, Auto Liability and Umbrella/Excess coverages together with a copy of the declaration page of the General Liability, Auto Liability and Umbrella/Excess policies with a list of endorsements and forms.

H. Each Certificate of Insurance must describe the services provided by the Contractor (e.g., roofing, carpentry, plumbing) that are covered by the liability policies.

I. At the Owner's request, the Contractor shall provide a copy of the policy endorsements and forms for the policies listed in paragraph A of this Article 10.

J. There will be no coverage restrictions and/or exclusions involving the New York State Labor Law or gravity related injuries. No policies containing escape clauses or exclusions contrary to the Owner's interest will be accepted.

K. 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.

L. In the event that any of the insurance coverage to be provided by the Contractor to the Owner contains a deductible or self-insured retention, or the insurance provided by the Owner contains a deductible, the Contractor shall indemnify and hold the Owner, the Architect and the Construction Manager harmless from the payment of such deductible or self-insured retention, which deductible and self-insured retention shall in all circumstances remain the sole obligation and expense of the Contractor.

M. The Contractor acknowledges that its failure to obtain or keep current the insurance

coverage required by paragraph A of this Article 10 shall constitute a material breach of contract and subjects the Contractor to liability for damages, including but not limited to direct, indirect, consequential, special and such other damages the Owner sustains as a result of such breach. In addition, the Contractor shall be responsible for the indemnification to the Owner, Architect and Construction Manager, of any and all costs associated with such lapse in coverage, including but not limited to reasonable attorney's fees.

N. The Contractor shall require all subcontractors to obtain and maintain the same types of insurance with the same limits of coverage and same additional insureds as set forth in paragraph A of this Article 10 and the subcontractors policies must comply with all the requirements set forth in this Article 10. Contractor shall confirm each subcontractors compliance with the insurance requirements of this Article 10 and collect proof of each subcontractor's insurance prior to the start of any work by the subcontractor. In the event a subcontractor fails to obtain the required insurance and a claim is made or suffered, the Contractor shall indemnify, defend, and hold harmless the Owner, Architect, Engineers, Construction Manager, Consultants, and Sub-consultants and their agents or employees from any and all claims for which the required insurance would have provided coverage. This indemnity obligation is in addition to any other indemnity obligation provided in the Contract Documents.

O. The Contractor assumes responsibility for all injury or destruction of the Contractor's materials, tools, machinery, equipment, appliances, shoring, scaffolding, false and form work, and personal property of Contractor's employees from whatever cause arises. Any policy of insurance secured covering such items that the Contractor or Subcontractors leased or hired and any policy of insurance covering the Contractor or Subcontractors against physical loss or damage to such property shall include an endorsement waiving the right of subrogation against the Owner for any loss or damage to such property.

P. The Owner in good faith may adjust and settle a loss with the Contractor's insurance carrier.

Q. Before commencement of its work, the Contractor shall obtain and pay for such insurance as may be required to comply with the indemnification and hold harmless provisions outlined under Article 12 of these General Conditions of the Contract for Construction.

R. Review and acknowledgment of the Certificate of Insurance by the Owner, Construction Manager or the Architect shall not relieve or decrease the liability of the Contractor hereunder.

S. 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.

ARTICLE 11

REQUIRED BONDS FOR THE PROJECT

A. The Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the State of New York.

B. All Surety companies are subject to the approval of the Owner and may be rejected by the Owner without cause.

C. Except as otherwise required by statute, the form and substance of such bonds shall be satisfactory to the Owner in the Owner's sole judgment.

D. Bonds shall be executed by a responsible surety licensed to do business in New York with an A.M. Best Rating of "A-" or better as to Policy Holder Ratings, and "VII" or better as to "Financial Size Category." Such bonds shall remain in effect for a period not less than two (2) years following final completion of the work by the Contractor.

E. Bonds shall further be executed by a surety that is currently listed on the U.S. Treasury Department Circular 570 entitled "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies," as amended.

F. The Performance Bond and the Labor and Material Payment Bond shall each be in an amount equal to 100% of the Contract Sum. The value of each bond shall be adjusted during the Project construction period to reflect changes in the Contract Sum.

G. Every Bond must display the Surety's Bond Number.

H. Each bond must be accompanied by an original Power of Attorney, giving the names of Attorneys-in-fact, and the extent of their bonding capacity.

I. A rider including the following provisions shall be attached to each Bond:

1. 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.

2. 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.

J. The Contractor shall deliver the required bonds to the Owner prior to beginning construction activity at the site, but no later than 10 days of issue date of Notice of Award of Contract. Said bonds shall be in the form set forth in the Project Manual. No work shall be performed by the Contractor until such bonds have been reviewed and approved.

K. The Owner may, in the Owner's sole discretion and without prior notice to the Contractor, inform surety of the progress of the 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.

L. If the surety on any Bond furnished by 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.

ARTICLE 12
INDEMNIFICATION

A. The Contractor and its subcontractors shall indemnify and hold harmless the Owner, Architect, and Construction Manager, and all their employees, agents or servants or any third parties from and against any and all claims, damages, losses, suits, obligations, fines, penalties, costs, charges and expenses, including but not limited to attorneys' fees, which may be imposed upon or incurred by or asserted against any of them by reason of any act or omission of such Contractor or any of its subcontractors or any person or firm directly or indirectly employed by such Contractor, for the act(s) and/or omission(s) of any Contractor or Subcontractor in connection with the work of the Project.

B. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, Construction Manager and agents 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 its work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction, of tangible property including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed

by them or anyone 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. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph B. The Contractor's indemnity obligations under this Paragraph B shall, but not by way of limitation, specifically include all claims and judgments which may be made against the Owner, the Architect, the Architect's consultants and agents and employees of any of them under any applicable statute, rule or regulation including the New York Statute, Occupational Safety and Hazardous Act, and the Federal Occupational Safety and Hazardous Act. In claims against any person or entity indemnified under this Paragraph B 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 this Paragraph B 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' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

C. The Contractor shall be liable for and shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any fines, penalties, judgments, or damages, including reasonable attorney's fees, imposed on or incurred by the parties indemnified hereunder which are incurred as a result of the Contractor's failure to give the notices of these General Conditions of the Contract for Construction.

D. The Contractor shall indemnify and hold harmless (1) the Owner, its consultants, employees, officers and agents, (2) the Architect and its consultants, employees, officers and agents, and (3) the Construction Manager, its consultants, employees, officers and agents, against any actions, lawsuits or proceedings or claims of liens brought against each or any of them as a result of liens filed against the Contractor's project funds, including all the cost and expense of said liens, and including but not limited to attorneys' fees incurred by each or any of them.

E. The Contractor shall indemnify and hold harmless the Owner, the Architect and the Construction Manager of and from any and all liability for violation of any laws and regulations applicable to the Contractor's work 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 to 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 fees, in recovering such defense costs from the Contractor.

F. The Contractor shall indemnify and hold harmless the Owner and the Architect of and from any and all liability for claims made by third parties, including subcontractors, in connection with this Agreement 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 to 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 fees, in recovering such defense costs from the Contractor.

ARTICLE 13
TIME FOR COMPLETION OF WORK

A. The date of commencement of the Contractor's work shall be as indicated in the agreement between the Contractor and the Owner. The date shall not be postponed or extended by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible to act. Time limits stated in the agreement between the Owner and the Contractor 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.

B. The Contractor shall not commence work on the site until two certified copies of all insurance policies and bonds required by Article 10 and Article 11 of these General Conditions of the Contract for Construction are provided to the Owner and accepted by the Owner. The date of commencement and/or completion of the Contractor's work shall not be changed by the effective date of such insurance. 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 acceptance of the insurance and bonds required by Article 10 and Article 11 of these General Conditions.

C. The Contractor shall proceed expeditiously with adequate forces and shall achieve substantial completion of its contract in accordance with the schedule set forth in its agreement. The Contractor shall cooperate with the Owner, Architect, Construction Manager, and other Contractors on the Project, making every reasonable effort to reduce the contract time.

D. 1. In the event the Owner determines that the performance of the Contractor's work, as of a milestone date, has not progressed or reached the level of completion required by its contract, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities and (3) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the Contractor progresses its work in compliance with the stage of completion required by its agreement with the Owner. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

2. The Contractor shall not be entitled to an adjustment in its contract sum in connection with Extraordinary Measures ordered by the Owner under or pursuant to this Paragraph D.

3. The Owner may exercise the rights furnished the Owner under or pursuant to this Paragraph D as frequently as the Owner deems necessary to ensure that the Contractor's performance of its work will comply with any Milestone Date or completion date set forth in the Contractor's agreement with it.

4. The Owner reserves the right to withhold payment from the Contractor until such time as the Contractor submits a daily schedule showing work to be again on schedule with the Construction Schedule and/or until its work is being installed according to the project construction schedule, without additional cost to the Owner.

E. The Contractor shall achieve substantial completion of its work in accordance with the schedule for the work set forth in the project manual included as part of its agreement with the Owner. Milestone Dates are dates critical to the Owner's operations that establish when a part of the work is to commence or be complete. All Milestone Dates are of the essence and shall have the same meaning as Substantial Completion for the purpose of Liquidated Damages in this Article 13.

F. Substantial completion shall be achieved by the Contractor when the Contractor has completed ninety eight (98%) of its work. Work remaining to be completed after substantial completion shall be limited to items which can ordinarily be completed within the period between the payment at the time of substantial completion and final payment.

G. 1. This project is to be physically completed in accordance with the time limits set forth in the agreement between the Owner and Contractor and as further set forth in the project manual and/or bidding documents. Liquidated damages will be assessed in the amount of $1,000.00 for each and every calendar day after such time allowed for completion.

2. Contractor realizes that time is of the essence on this Contract and the completion date and milestone date for each work item in its agreement, a Milestone Date reflected on the project schedule, or the date of substantial 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 under this contract 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 time in accordance with the provisions of this Article 13.

3. 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. Such Liquidated Damages shall be in addition to any other damages (other than by reason of delay) Owner may incur as a result of Contractor's breach of Contract. In

the event that substantial completion of its work is not achieved in accordance with the project schedule, inspections will be performed once each week unless the Owner or the Architect determines, at their sole discretion, that additional inspections are not needed. All costs incurred by the Owner, Owner's Representative and the cost of additional inspections, at the rate of One Thousand Dollars ($1,000) per inspection, will be subtracted from payment due the Contractor. If the amount due the Contractor for payment is insufficient, any deficiency shall be paid by the Contractor to the Owner.

H. 1. Within five (5) calendar days from the occurrence of same, the Contractor must apply in writing to the Owner, its Architect or Construction Manager for an extension of time to complete its work where it has been delayed as a result of: unforeseeable causes beyond the control and without the fault or negligence of the contractor, including acts of God, acts of the public enemy, acts of the federal or state government in either their sovereign or contractual capacities, fires, floods, epidemics, quarantine restrictions, priority or allocation orders duly issued by the federal government; freight embargoes; changes in the work to be performed by the Contractor. The Contractor may not apply for an extension of time for delays in acquisitions of materials other than by reason of freight embargoes. All other delays of the project, including but not limited to, Architect review and/or approval of shop drawings and/or submittals, requests for information, clarifications, samples, and change orders; Owner schedule; Architect certification of payment; payment by Owner of Contractor's Application for Payment; coordination amongst Contractors; unavailability of materials and/or equipment; surveying/testing; closeout, etc. are deemed to be foreseeable and, therefore shall not form the basis for a claim for an extension of time by the Contractor.

2. <u>All claims for additional time shall be 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.</u> 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. Where 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; only the actual period of delay as determined by the Owner or its Architect may be allowed.

3. Notwithstanding anything to the contrary in the Contract Documents, an extension in the contract time, to the extent permitted under subparagraph H of this Article 13, shall be the sole remedy of the Contractor for 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 similar claims (collective referred to herein as "delay(s)"), unless a delay is caused by the Owner's active interference with the Contractor's performance of the Work, and only to the extent such acts continue after the Contractor furnishes the Owner with three (3) days' written notice of such interference. 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, 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 active interference with the Contractor's performance of the Work.

ARTICLE 14
DEFICIENT AND INCOMPLETE WORK

A. The Architect will have the authority to reject work performed by the Contractor which does not conform to the requirements of the drawings and/or specifications.

B. The Architect shall have the authority to require additional inspection or testing of the Contractor's work whether or not such work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing portions of the work to have performed additional inspection or testing of the work.

C. 1. If a portion of the Contractor's work is covered contrary to the Architect's request or to requirements specifically expressed in the drawings and/or specifications, upon request by the Architect or the Construction Manager, the Contractor shall uncover such work for the Architect's or any governmental authority's observation and be replaced at the Contractor's sole expense without change in the Contract Time or Contract Sum.

2. If a portion of the Contractor's work has been covered which the Architect or any governmental authority has not specifically requested to observe prior to its being covered, the Architect or any governmental authority may request to see such work and it shall be

uncovered by the Contractor. If such work is in accordance with the drawings and/or specifications, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor, at its sole cost and expense, shall uncover and replace such work.

D. The Contractor shall promptly correct work rejected by the Architect or failing to conform to the requirements of its contract with the Owner, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear the all costs of correcting such rejected work, including but not limited to the cost of said additional testing and/or inspection, the cost of the Architect's services incurred in conjunction with such additional testing, and any cost, loss or damages to the Owner resulting from such actions. If prior to the date of Substantial Completion, the Contractor, a Sub-contractor or anyone for whom either is responsible uses or damages any portion of the Work or premises, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

E. If the Contractor (1) fails to correct work which is not in accordance with the requirements of its agreement with the Owner, or (2) fails to carry out its work in accordance with the requirements of its agreement with the Owner, 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 ten (10) days) any lien filed upon Owner's property by anyone claiming by, through, or under the Contractor, or (5) disregards the instructions of the Architect, Owner or Construction Manager, the Construction Manager, on behalf of the Owner may order the Contractor to stop its work, or any portion 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. This right shall be in addition to, and not in restriction of, other rights the Owner may have pursuant to these General Conditions or at law.

F. 1. If the Contractor defaults or neglects to carry out its work in accordance with its agreement with the Owner and fails within a three (3) day period after receipt of written notice from the Construction Manager to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Architect, the Construction Manager and the Owner and such other consultants whose participation is deemed necessary by the Architect, for additional services and expenses made necessary by such default, neglect or failure. Such action by the Construction Manager, including the amounts to be charged to the Contractor as a result of such action

are subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

2. Where the Contractor's default and/or neglect to carry out its work in accordance with its agreement with the Owner threatens the health, safety and/or welfare of the occupants of the school district's facilities and/or threatens the structural integrity and/or preservation of the school district'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.

G. If the Owner prefers to accept work which is not in accordance with the terms and conditions of the agreement between the Owner and the Contractor, the Owner may, in its discretion, accept such work and reduce the Contractor's contract sum accordingly.

ARTICLE 15
FINAL COMPLETION AND CLOSEOUT OF THE PROJECT

A. 1. When advised by the Construction Manager that the Contractor's work is near substantial completion, the Architect shall visit the site to determine whether the Contractor's work is substantially complete. If the Architect's observations of the Contractor's work discloses any item which has not been performed in accordance with the requirements of the drawings and/or specifications and/or which has not been completed to the point indicated in Article 13 paragraph F of these General Conditions, the Contractor shall complete or correct such items upon receipt of notification from the Architect that a deficiency exists. The Architect shall not issue a certificate of substantial completion for the work of the Contractor until the work has been completed in accordance with Article 13(F). Upon completion of the work outlined by the Architect to it in accordance with this paragraph A, the Contractor shall advise the Architect of the need for an inspection of the work. If the Architect is required to inspect the Contractor's work more than twice, the Contractor shall be liable to the Owner for the services performed by the Architect as a result of additional inspections.

2. Upon determining that the Contractor's work has progressed to the point of Substantial Completion, the Architect shall prepare a punch list of the Contractor's work which shall include only minor items of work remaining to be performed by the Contractor to bring its work into compliance with the requirements of the drawings and/or specifications. The Contractor shall proceed promptly to complete and correct items on the punch list issued by the Architect and shall complete said items within thirty (30) days of its receipt of the punch list from the Architect. At the time of substantial completion, the Owner shall retain 200 percent of the value of the punch list items from the Contractor's remaining contract sum. The value of said remaining work shall be determined by the Architect. Upon completion of the work reflected in the final punch list, the Owner shall release the monies withheld pursuant to this paragraph to the Contractor.

3. The Architect's failure to include an item of deficiency on the punch list issued to the Contractor shall not relieve the contractor of its responsibility to perform its work in accordance with the drawings and/or specifications.

B. 1. If within two (2) years after the date of Substantial Completion of the Contractor's work or designated portion thereof, or after the date for commencement of warranties established pursuant to these General Conditions, or by terms of in applicable special warranty required by the agreement between the Owner and the Contractor, any of the Work is found to be not in accordance with the requirements of said agreement, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of two (2) years shall be extended with respect to portions of the Contractor's work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of such work. The obligation set forth hereunder shall survive acceptance by the Owner of the Contractor's and/or termination of the Contractor's agreement with the Owner. The Owner shall give such notice within a reasonable period of time after discovery of the condition.

2. The Contractor shall, within a reasonable time after receipt of written notice thereof, but in no event no later than seventy-two (72) hours after receipt of such notice, commence to correct, repair, and make good any defects in its work.

3. The obligations of the Contractor pursuant to this paragraph shall cover any repairs to or replacement of work affected by the defective work.

4. In the case of any work performed in correcting defects pursuant to this paragraph, the guarantee periods specified herein shall begin anew from the date of acceptance by the Owner of such work.

C. Upon receipt of written notice from the Construction Manager that the Contractor's work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Contractor's work acceptable pursuant to the terms and conditions of its agreement with the Owner and the Contract fully performed and upon receipt of the closeout documentation required by the Contract Documents and elsewhere in the agreement between the Owner and the Contractor, the Architect will certify to the Owner that the Contractor is entitled to final payment on the project.

D. 1. Prior to receipt of final payment from the Owner, the Contractor shall provide to the Architect the close out documentation required by the Contract Documents.

2. The Contractor shall schedule a close out meeting with the Architect and the Construction Manager for the purpose of delivering the close out documents required

pursuant to the Contract Documents and elsewhere in the agreement between the Owner and the Contractor.

E. If the Contractor's 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 warranty periods described in the Contract Documents shall be set by the Architect at his discretion.

F. If the Architect is required to perform more than one final inspection because the Contractor's work fails to comply with the requirements of the contract, the amount of compensation paid to the Architect by the Owner for additional services shall be deducted from the final payment to the Contractor.

G. Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those claims previously made in writing in accordance with the terms of Article 18 hereof and identified by that payee as unsettled at the time of final Application for Payment.

H. Contractor shall submit all documentation identified in this section within ninety (90) days from the date of Substantial Completion. If the documentation has not been submitted, the Owner will obtain same through whatever means necessary. The Contractor shall solely be responsible for all expenses incurred by the Owner in securing such documentation.

ARTICLE 16
RELEVANT STATUTORY PROVISIONS

A. The Contractor shall at all times observe and comply with all Federal and State 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 indemnify and save harmless the Owner and all his 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.

B. The Contractor and each of its subcontractors 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 and shall comply with all requirements governing its payments to its employees as set forth in Labor Law, section 220 et seq of the New York State Labor Law, as amended.

C. The Contractor and each of its subcontractors shall post a notice at the beginning of the performance of every public work contract on each job site that includes the telephone

number and addresses 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 particular job classification.

D. The Contractor specifically agrees, as required by Labor Law, Sections 220 and 220-d, as amended, that:

1. No laborer, workman 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 contemplated by the Contract, shall be permitted or required to work more than eight hours in any one calendar day or more than five days in any one week, except in the emergencies set forth in the Labor Law.

2. The wages paid for a legal day's work shall not be less than the prevailing rate of wages as defined by law.

3. The minimum hourly rate of wages to be paid shall not be less than that stated in the Project Manual, and any re-determination of the prevailing rate of wages after the Contract is approved shall be deemed to be incorporated herein by reference as of the effective date of re-determination and shall form a part of this Contract. The Labor Law provides that the Contract may be forfeited and no sum paid for any work done thereunder on a second conviction for willfully paying less than:

a. The stipulated wage scale as provided in Labor Law, Section 220, Sub division 3, as amended; or

b. The stipulated minimum hourly wage scale as provided in Labor Law, Section 220-d, as amended.

E. The Contractor acknowledges that its work is governed by the provisions of Section 101 of the General Municipal Law of the State of New York.

F. The Contractor specifically agrees, as required by the provisions of the Labor Law of New York, Section 220-E, as amended that:

1. In the hiring of employees for the performance of this contract or any sub-contractor hereunder, no contractor, sub-contractor, nor any person acting on behalf of such contractor or sub-contractor shall by reason of race, creed, color 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, sub-contractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, color, creed, sex or national origin.

3. There may be deducted from the amount payable to the Contractor a penalty of 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.

4. This Contract may be canceled or terminated by the Owner and all monies due or to become due hereunder may be forfeited for a second or any subsequent violation of the terms or conditions of this section of the Contract.

The aforesaid provisions of this section covering every Contract for or on behalf of the Owner, the State or a municipality for the manufacture, sale or distribution of materials, equipment or supplies shall be limited to operations performed within the territorial limits of the State of New York.

G. The successful Contractor shall conform to the guidelines spelled out in the County's Affirmative Action Program, if any.

H. The Contractor shall comply with all of the provisions of the Immigration Reform and Control Act of 1986 and regulations promulgated pursuant thereto and shall require its subcontractors to comply with same. The Contractor shall and does hereby agree to fully indemnify, protect, defend, and hold harmless the Owner, Owner's agents and employees from and against any penalties, fees, costs, liabilities, suits, claims, or expenses of any kind or nature, including reasonable attorney's fees, arising out of or resulting from any violation or alleged violation of the provisions of said laws in connection with the work performed hereunder.

I. This Contract shall be void if the Contractor fails to install, maintain, and effectively operate appliances and methods for the elimination of harmful dust when a harmful dust shall have been identified in accordance with Section 222-a of the Labor Law of the State of New York.

J. The Contractor shall insure that absolutely no asbestos containing material is used in conjunction with the performance of its work. The Contractor bears the sole responsibility to provide assurances that no asbestos containing material is built into the construction, or that any equipment used in the construction contains any asbestos containing material. If asbestos containing material is found, at any time during or after the construction is completed, it shall be the responsibility of the Contractor who installed said material to remove it and replace it with new non-asbestos containing material, as per federal, state and local mandates.

K. Large and small asbestos abatement projects as defined by 12 N.Y.C.R.R. 56 shall not be performed while the building is occupied. As referenced in this section, the term "building" shall mean a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion, and ventilation systems must be physically separated and sealed at the isolation barrier. Exterior work such as roofing, flashing, siding or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and windows is provided. Work must be scheduled so that classes are not disrupted by noise or visual distraction.

L Surfaces that will be disturbed by reconstruction must have a determination made as to the presence of lead. Projects which disturb surfaces that contain lead shall have in the specifications a plan prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning and clearance testing which are in general accordance with the HUD Guidelines.

M. No smoking is allowed anywhere on school property per New York State and County law. Violators are subject to a $1,000 fine and/or banishment from the property.

N. Applicable codes and standards for material furnished and work installed shall include all state laws, local ordinances, requirements of governmental agencies having jurisdiction, and applicable requirements of following codes and standards, including but not limited to:

1. New York State Uniform Fire Prevention and Building Code, and amendments thereto.

2. New York State Energy Conservation Construction Code.

3. State Education Department Manual of Planning Standards.

4. New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials, latest edition.

5. Life Safety Code - NFPA.

O. Wherever in the specifications reference is made to ANSI or ASTM Standards, Federal Specifications, Consumer Product Standards, or similar recognized standards, the latest edition of the respective publishing agency in effect at the date of "Bid Issuance" shall be accepted as establishing the technical requirements for which compliance is required.

P. The Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions of its agreement in the event (1) an order for relief is entered on behalf of the Contractor pursuant to Title 11 of the United States Code, (2) any other similar order is entered under any other debtor relief laws, (3) the Contractor makes a general assignment for the benefit of its creditors, (4) a receiver is appointed for the benefit of its creditors, or (5) a receiver is appointed on account of its insolvency. Failure to comply with such request within ten (10) days of delivery of the request shall entitle the Owner to terminate the Contract in accordance with Article 17 hereof. In all events, pending receipt of adequate assurance of performance and actual performance in accordance therewith, the Owner shall be entitled to proceed with the Contractor's work with its own forces or with other contractors on a time and material or other appropriate basis, the cost of which will be back charged against the Contractor.

Q. The Contractor shall maintain policies of employment as follows:

1. The Contractor and the Contractor's 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 insure that 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. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

2. The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

ARTICLE 17
TERMINATION OR SUSPENSION

A. 1. The Owner may terminate the Contractor's agreement in the event the Contractor:

a. refuses or fails to supply sufficient skilled workers or suitable materials or equipment to complete the Work in a diligent, efficient, timely, workmanlike, skillful, and careful manner;

b. refuses or fails to correct deficient work performed by it;

c. fails to make prompt payments to subcontractors for labor, materials, and/or equipment in accordance with the respective agreements between the Contractor and the Subcontractors;

d. disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;

e. disregards the instructions of the Architect, Construction Manager or the Owner (when such instructions are based on the requirements of the Contract Documents);

f. is adjudged a bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act or to reorganize under bankruptcy or similar laws; or

g. breaches any warranty made by the Contractor under or pursuant to the Contract Documents.

h. fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with all the requirements of the Contract Documents; or

i. fails after commencement of the Work to proceed continuously with the construction and completion of the Work for more than ten (10) days, except as permitted under the Contract Documents.

j. fails to keep the Project free from strikes, work stoppages, slowdowns, lockouts or other disruptive activity;

k. or otherwise does not fully comply with the Contract Documents.

2. When any of the above reasons exists, may without prejudice to any other rights or remedies of the Owner, terminate employment of the Contractor upon three (3) days written notice and may, subject to any prior rights of the surety:

a. take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

b. take possession of materials stored off site by the Contractor;

c. take assignments of the Contractor's subcontractors in accordance with these General Conditions;

d. finish the Work by whatever reasonable method the Owner may deem expedient.

3. When the Owner terminates the Contract for one of the reasons stated in Subparagraph 1 hereof, the Contractor shall not be entitled to receive further payment until the completion of the Contractor's work. If the Owner's costs to complete the Contractor's work, including the expenses incurred by the Owner in connection with the services of the Architect, the Construction Manager and/or other consultants, exceed the contract balance remaining on the Contractor's contract, the Contractor shall be liable to the Owner for such excess costs. This provision shall survive termination of the Contractor's agreement with the Owner.

4. In the event a court or other tribunal issues a final determination that Owner's termination for cause was arbitrary, capricious or otherwise without cause and/or reverses Owner's termination for cause, such termination shall, without further action on the part of Owner, be converted to a termination for convenience, as set forth in (B), below.

B. 1. In addition to the Owner's right to carry out the work of the Contractor pursuant to its agreement with the Contractor, the Owner may at any time, at will and without cause, terminate any part of the Contractor's work or all of the Contractor's remaining work for any reason whatsoever by giving three (3) days' written notice to Contractor, specifying the portion of the Contractor's work to be terminated and the effective date of termination.

2. Upon receipt of a notice of termination for convenience, the Contractor shall immediately, in accordance with instructions from the Owner, proceed with performance of the following duties regardless of delay in determining or adjusting amounts due under this Paragraph:

a. cease operation as specified in the notice;

b. place no further orders and enter into no further subcontracts for materials, labor, services or facilities except as necessary to complete continued portions of the Contract;

c. terminate all subcontracts and orders to the extent they relate to the Work terminated;

d. proceed to complete the performance of the remaining work on its contract which has not been so terminated; and

e. take actions that may be necessary, or that the Owner may direct, for

the protection and preservation of the terminated Work.

3. The Contractor shall continue to prosecute that portion of its work which has not been terminated by the Owner pursuant to this paragraph. If the Contractor's work is so terminated, the Owner shall not be liable to the Contractor by reason of such termination except that the Contractor shall be entitled to payment for the work it has properly executed in accordance with its agreement and prior to the effective date of termination (the basis for such payment shall be as provided in the Contract) and for costs directly related to work thereafter performed by Contractor in terminating such Work, provided such work is authorized in advance by the Architect and the Owner. No payment shall be made by Owner, however, to the extent that such work is, was, or could have been terminated under the Contractor's agreement with the Owner.

4. In case of a termination pursuant to this paragraph B, the Owner will issue a Construction Change Directive or authorize a Change Order, making any required adjustment to the Date of Substantial Completion and/or the sum of contract monies remaining to be paid to the Contractor. The Owner shall be credited for (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 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.

5. For the remaining portions of the Contractor's work which have not been terminated pursuant to this paragraph B, the terms and conditions of the Contractor's agreement with the Owner shall remain in full force and effect.

6. Upon termination of the Contractor's work or a portion of the Contractor's work pursuant to this paragraph B, the Contractor shall recover as its sole remedy, payment for work which it has properly performed in connection with the terminated portion of the Work prior to the effective date of termination and for items properly and timely fabricated off the Project site, delivered and stored in accordance with the Owner's instructions. The Contractor hereby waives and forfeits all other claims for payment and damages, including, without limitation, overhead and profit related to work terminated by the Owner pursuant to this paragraph B.

C. 1. In addition to Owner's right to suspend, delay, or interrupt Contractor from proceeding with any portion of its work pursuant to the terms and conditions of its agreement with the Owner, the Owner may at any time, at will and without cause suspend, delay, or interrupt any part of the Contractor's work or all work for any reason whatsoever for such period of time as the Owner may determine by giving three (3) days' prior written notice to Contractor, specifying that portion of the Contractor's work which is to be suspended, delayed, or interrupted, and the effective date of such suspension, delay, or interruption, as the case may be.

2. The Contractor shall continue to prosecute that portion of its work which has not been suspended, delayed, or interrupted, and shall properly protect and secure the portion of its work so suspended, delayed or interrupted.

3. The Owner shall incur no liability to Contractor by reason of such suspension, delay, or interruption except that Contractor may request an extension of its time to complete its work in accordance with Article 13 hereof.

D. 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 18
CLAIMS AND DISPUTES

A. Definition. A "Claim" is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time 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.

B. Time Limits on Claims. Claims by the Contractor must be made within thirty (30) days after occurrence of the event giving rise to such Claim, or within thirty (30) days after the claimant first recognizes the condition giving rise to the Claim, whichever is earlier. Claims must be made by written notice. An additional Claim made after the initial Claim has been decided by the Owner will not be considered unless submitted in a timely manner. Failure of the Contractor to give timely notice of claim shall constitute waiver of the claim. Claims must be made by written notice to the Construction Manager, Architect and Owner. The responsibility to substantiate Claims shall rest with the Contractor.

C. Pending final resolution of a Claim, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

D. Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which 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, then notice by the Contractor shall be given to the Owner and Architect promptly before conditions are disturbed and in no event later than five (5) days after first observance of the conditions; and, (3) in the case of a condition at the site which involves a hazardous or toxic substance, 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 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 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 so notify the Contractor in writing, stating the reasons.

E. Claims for Additional Cost. If the Contractor wishes to make Claim for an increase in the Contract Sum as a result of a Change in the Work pursuant to Article 8 of these General Conditions, written notice as provided in this Article 18 shall be given before proceeding to execute the Work.

F. Claims for Additional Time. If the Contractor wishes to make Claim for an increase in the Contract Time, the Contractor shall comply with the requirements set forth in Article 13.

G. 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.

ARTICLE 19
MISCELLANEOUS PROVISIONS

A. The agreement between the Owner and the Contractor shall be governed by the law of the place where the project is located; venue to be in the County in which the project is located.

B. 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 its agreement with the Owner 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.

C. 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 hereinbelow. 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.

D. Except as expressly provided in the agreement between the Owner and the Contractor, duties and obligations imposed by such agreement 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, or in equity or by other agreement, and such rights and remedies shall survive acceptance of the Contractor's work and/or any other termination of the Contractor's agreement with the Owner.

E. No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

F. The headings denoting the separately numbered Articles of these General Conditions are specifically set forth for reference purposes only and are not in any way to be deemed explanatory of or limiting of the contents of any paragraph or subparagraph. Furthermore, said headings are not to be deemed part of this Agreement for purposes of interpretation, litigation or as defining or limiting the rights or obligations of the parties.

G. In case any provision of this Agreement should be held to be contrary to, or invalid, under the law of any country, state or other jurisdiction, such illegality or invalidity, shall not affect in any way, any other provisions hereof, all of which shall continue, nevertheless, in full force and effect in any country, state or jurisdiction in which such provision is legal and valid.

H. The rights stated in these General Conditions and the documents which form the agreement between the Owner and the Contractor are cumulative and not in limitation of any rights of the Owner at law or in equity.

I. 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 pursuant to its agreement with the Contractor.

J. The Owner shall not be liable to the Contractor for punitive damages on account of any its termination of the Contractor or any other alleged breach of the agreement between it and the Contractor and the Contractor hereby expressly waives its right to claim such damages against the Owner.

K. 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.

L. Upon determination by legal means (e.g. court action, etc.) that termination of Contractor pursuant to Article 17.A.1 was wrongful, such termination will be deemed converted to a termination for convenience pursuant to Article 17.B.1 and Contractor's remedy for such termination shall be limited to the recovery of the payments permitted for termination for convenience as set forth in Article 17.B.1.

M. As between the Owner and Contractor:

1. Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;

2. Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

3. After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged 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 warranties provided in accordance with its agreement with the Owner, the date of any correction of work performed by the Contractor or failure to correct its work, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

N. 1. The Owner may occupy or use any completed or partially completed portion of the Contractor's work at any stage when such occupancy is authorized by public authorities having jurisdiction over the project.

2. Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of the Contractor's work, nor does it waive the Owner's right to liquidated damages. Further such occupancy alone shall not determine when substantial completion and performance has been reached

3. Immediately prior to such partial occupancy or use, the Owner, 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 Contractor's work, and in order to prepare a complete punchlist of omissions of materials, faulty workmanship, or any items to be repaired, torn out or replaced.

O. The Contractor agrees not to assign, transfer, convey or sublet or otherwise dispose of this Contract or his right, title and interest therein or his power to execute such Contract, to any other person, firm or corporation without the previous consent in writing of the Owner.

P. The Owner is a tax exempt organization and will take title to materials used in the Project in order to permit tax exemption.

Q. The Owner will furnish a certificate with the Owner's Tax Exemption Number to the Contractor for use in purchasing tangible personal property required for the Project.

R. This exemption shall not apply to machinery, equipment, tools, and other items purchased, leased, rented, or otherwise acquired for the Contractor's use even though the machinery, equipment, tools or other items are used either in part or entirely on the Work. This exemption shall apply only to materials fully incorporated into the Work of the Contract as accepted and approved by the Architect.

S. The Contractor shall, upon request by the Owner, furnish a bill of sale or other instrument indicating the quantities and types of materials purchased directly by the Contractor or subcontractor for incorporation into the Work. Upon delivery of the materials to the site, the Contractor shall mark or otherwise identify the materials to be incorporated into the Work. This exemption shall apply only to materials so identified and accepted.

END OF GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

NYSED 155.5 REGULATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies requirements of 8NYCRR155.5, Uniform Safety Standards for School Construction and Maintenance Projects, that are required in construction documents. The Contractor shall comply with these requirements in addition to any and all similar requirements in the Contract Documents.

1.3 REQUIREMENTS

A. The occupied portion of any school building shall always comply with the minimum requirements necessary to maintain a certificate of occupancy. In addition, the following shall be strictly enforced and cooperated with:

1. No smoking is allowed on public school property, including construction areas.
2. During construction daily inspections of district occupied areas shall be conducted by school district personnel to assure that construction materials, equipment or debris do not block fore exits or emergency egress windows.
3. Proper operation of fire extinguishers, fire alarm, and smoke/fire detection systems shall be maintained throughout the project.

B. Verify that all school areas to be disturbed during renovation or demolition have been or will be tested for lead and for asbestos. For any project work that disturbs surfaces that contain lead or asbestos, follow the plans and specifications prepared by a certified Lead Risk Assessor or Supervisor which details provisions for occupant protection, worksite preparation, work methods, cleaning, and clearance testing; which are in general accordance with HUD Guidelines.

1. All asbestos abatement projects shall comply will all applicable federal and State laws including but not limited to the New York

State Department of Labor industrial code rule 56(12NYCRR56), and the federal Asbestos Hazard Emergency Response Act (AHERA), 40 CFR Part 763 (Code of Federal Regulations, 1998 Edition); available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234.

2. 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 (HUD), Washington, D.C. 20410; available at the Office of Facilities Planning, Education Building Annex, Room 1060, State Education Department, Albany, NY 12234.

C. 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 warnings 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.

D. Separation of construction areas from occupied spaces. 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.

1. A specific stairwell and/or elevator may be assigned for construction worker use during the work hours. In general,

workers may not us the corridors, stairs or elevators designated for students or school staff.

2. 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.
3. All occupied parts of the buildings 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.

E. The Architect will prepare phasing plans indicating exiting, required by the applicable building code, which shall be maintained during construction.

1. The Contractor shall submit plans, to be approved by the Architect, indicating temporary construction required to isolate construction equipment, materials, people, dust, fumes, odors, and noise during the construction period and meeting the requirements of the phasing plans.
2. Temporary construction details shall meet code-required fire ratings for separation and corridor enclosure.
3. At a minimum, required exits, temporary stairs, ramps, exit signs, and door hardware shall be provided at all times.

F. Prepare a plan detailing how adequate ventilation will be maintained during construction.

1. 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.
2. The plan shall also indicate how required ventilation to occupied spaces affected by construction will be maintained during the project.

G. 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.

H. The contractor shall be responsible for the control of chemical fumes, gases, and other contaminates produced by welding, gasoline or diesel engines, roofing, paving, painting, etc. to ensure they do not enter occupied portions of the building or air intakes.

I. The contractor shall be responsible to ensure that activities and materials which result in "off-gassing" of volatile organic compounds such as glues, paints, furniture, carpeting, wall covering, drapery, etc. are scheduled, cured or ventilated in accordance with manufacturers recommendations before a space can be occupied.

J. Large and small asbestos abatement projects as defined by 12NYCRR56 shall not be performed while the building is occupied. The term "building", as used in this paragraph, means a wing or major section of a building that can be completely isolated from the rest of the building with sealed non-combustible construction. The isolated portion of the building must contain exits that do not pass through the occupied portion, and ventilation systems must be physically separated and sealed at the isolation barrier.

K. Exterior work such as roofing, flashing, siding, or soffit work may be performed on occupied buildings provided proper variances are in place as required, and complete isolation of ventilation systems and at windows is provided. Care must be taken to schedule work so that classes are not disrupted by noise or visual distraction.

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# 2025003470

https://apps.labor.ny.gov/wpp/publicViewProject.do?method=showIt&id=1585927

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

White Plains City School District
Board of Education
5 Homeside Lane, White Plains, NY 10605
White Plains, NY 10605

U.S. Department of Labor
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions at www.dol.gov/whd/forms/wh347instr.htm)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

U.S. Wage and Hour Division

Rev. Dec. 2008

OMB No.: 1235-0008
Expires: 02/28/2018

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
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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 231 OF TITLE 31 OF THE UNITED STATES CODE.

PART 1 - GENERAL

1.01 BRIEF PURPOSE OF PROJECT / GENERAL

A. The purpose of the project is for a new 48,600 SqFt two (2) story w./ partial basement) and pedestrian bridge connection to the existing High School 'A' Wing. Work includes a classroom renovation to the existing building to accept the new Student Enterprise 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. Each Contractor has been provided with copies of all relevant construction drawings for related construction contracts whose work may directly effect and impact the work under this Contract.
   1. Each Contractor shall provide a complete and operational project in anticipation of these affects and impacts.
   2. It is each Contractor's responsibility to investigate the work that will be performed by others and consider such in the conduct of his/her work.

D. 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 terms "Contractor" and/or "Prime Contractor" where used shall refer to the individual or company who has entered into an agreement with the Owner to perform the work contained within these Contract Documents. The lack of word capitalization shall be incidental.

C. The terms "Contractor" and/or "Prime Contractor" where used within the body of a specific Construction Contract, (i.e.; Contract M, Contract G, Contract E, Contract P, and Contract C), shall refer to the individual or company who has entered into an agreement with the Owner to perform the work contained within those Contract Documents. The lack of word capitalization shall be incidental.

D. 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.

E. 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.

F. The Heating, Ventilating & Air Conditioning Construction Contractor may be referred to as the "HVAC Contractor", "Prime HVAC Contractor", "Contract M Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract M.

G. 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.

H. The SITE WORK Construction Contractor may be referred to as the "Site Work Contractor", "Prime Site Work Contractor", "Contract C Contractor" or similar wording. The lack of word capitalization shall be incidental. This Construction Contract shall be known as Contract C.

I. 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, White Plains City School District.

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. New 48,600 SqFt two (2) story w./ partial basement) and pedestrian bridge connection to the existing High School 'A' Wing. Work includes a classroom renovation to the existing building to accept the new Student Enterprise space
2. Demolition and removals as shown,
3. Excavation, removal of excess and/or unsuitable excavated material, sheeting reinforcement, import of suitable material, soil compaction and testing.
4. 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.
5. Surface preparation and coating of structural steel, walls, and other items as noted.
6. Install epoxy floor coating system.
7. 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. Arrange for and install primary electric service.
3. Main secondary feeders, power distribution, and instrumentation control wiring. Provide, mount, and install electrical conduit, wire, fittings, boxes, panels, and electrical accessories.

4. All clearing, excavation, filling, and backfilling associated with the installation of underground conduit, duct bank, or wiring.
5. Emergency generators including the construction of its concrete slab.
6. Motor control centers, local control stations, transfer switches, power distribution panels, breakers, lights, and switches.
7. Furnish, install and power primary flow elements, transmitters, flow recorders and install interconnecting wiring where said devices are to be provided as work of Contract E. Install and power primary flow elements, transmitters, flow recorders and install interconnecting wiring where said devices are to be provided as work of other contracts.
8. 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.
9. Electrical connections (final termination) to all equipment, control panels, ventilating equipment and electrical devices.
10. 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.
11. Removal of existing components as noted.
12. New secondary feeders, power distribution, and instrumentation control wiring. New electrical conduit, wire, fittings, boxes, panels, and electrical accessories.
13. New lighting fixtures, wiring and associated equipment.
14. Furnish, install and power primary flow elements, transmitters, flow recorders and install interconnecting wiring where said devices are to be provided as work of Contract E. Install and power primary flow elements, transmitters, flow recorders and install interconnecting wiring where said devices are to be provided as work of other contracts.
15. All excavation, trenching, backfilling, and rough grading associated with the installation of pull-boxes, underground conduit, and wiring. Final restoration by Contract C.
16. Final electrical terminations to all control panels, pumping equipment, blowers, HVAC equipment, etc.
17. Wiring connections to all electrical equipment (including equipment furnished by others).
18. Testing, programming and adjusting of all electrical systems.
19. 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.
20. Project closeout submittals.

D. All other work shown and specified in the Contract Documents for Contract E.

1.05 ABBREVIATED SUMMARY OF CONTRACT M 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 gas-fired unit heaters.

4. New hydronic unit heaters and associated piping.
5. New exhaust fans, supports, and associated equipment.
6. New grilles, registers, duct work, supports and accessories.
7. Furnish louvers and coordinate location for Contract G to install.
8. New air conditioning system.
9. Testing and balancing of systems.
10. 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. New natural gas piping, equipment, and meter. Coordination with local utility.
5. New interior large mechanical piping, valves, and accessories.
6. New buried site piping, valves, and accessories.
7. New penetration sleeves, placement to be coordinated with Contract G.
8. New sewer manhole structure, sewer connection and associated work.
9. New pumps, motors, and accessories.
10. Surface preparation and coating of all mechanical piping.
11. New water service lines.
12. New sump pumps, drainage piping, valves, and accessories.
13. Testing and adjusting of mechanical systems.
14. Disinfection and water quality testing.
15. 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.
16. Project closeout submittals.

D. All other work shown and specified in the Contract Documents for Contract P.

1.07 ABBREVIATED SUMMARY OF CONTRACT C 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. Excavation, trenching, backfill, re-grading, seeding, sidewalk, asphalt paving, bollards, light poles, ramps, railings, fencing, etc.
   2. Project closeout submittals.

D. All other work shown and specified in the Contract Documents for Contract C.

1.08 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
   2. Adherence to work restrictions as specified in Section 012100. Such restrictions include, but are not limited to:
      a. Guidelines and requirements of the "Owner"
   3. The General Contractor shall comply with the requirements of Section 312333 - Trenching. The cost associated with test holes and utility mapping shall be as specified therein, and is subject to change based on conditions existing at the time of construction.
   4. Guidelines and requirements of the New York State Department of Environmental Conservation (NYSDEC).
   5. Guidelines and requirements of the local Health Department.
   6. Local gas utility requirements for new services, connections, alterations and related work.
   7. 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.

1.09 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. Coordination with the Owner and other contractors who have been awarded work by the Owner.
   3. Coordination with utility companies necessary to schedule connection of services, and management of the installation.
   4. Site utilization and management so as not to disrupt the Owner’s ability to operate the existing facilities in a safe and efficient manner.
   5. Maintain the Owner’s ability to operate the facility at all times during the construction period.
   6. Facilities to be used during the contract period that are to be used by the Owner or his representatives and others involved with constructing the project.
   7. Product and equipment storage and handling requirements.
   8. Starting and adjusting of the equipment and systems required under the project.
   9. Site safety in accordance with all applicable federal, state, and local regulations.
   10. Project submittals, testing services, work plans, schedules, shop drawings, closeout procedures and documents, manuals, as-built drawings, final commissioning, of the work shall be provided as required by the Contract.

11. Provide and maintain, at all times, temporary roadways for site access to all parties involved with the project.
12. Sequence and schedule the construction so that new facilities come on-line before pre-existing facilities are demolished, dismantled or taken offline.
13. Temporary facilities and controls necessary to construct the project and to maintain permit levels of sewage treatment at all time.
14. Site utilization and management so as to allow other prime contractors to perform work in conjunction with this project and to afford them equal opportunity and space to complete their contractual obligations with the Owner as solely defined by the Architect/Engineer.
15. To not hinder the Owner's ability to deliver a safe and potable water supply.
16. To not hinder the Owner's ability to maintain permit levels of sewage treatment at all times.

B. Each Contractor shall coordinate the work between the various construction contracts, through the Owner/Architect/Engineer, as required to complete the contract requirements in accordance with the requirements contained in Section 013100.

1.10 OWNER SUPPLIED PRODUCTS AND UTILITIES

A. The Owner will not be supplying equipment, labor, or tools for the project.

B. The Owner will be supplying products or materials for the project as follows:
1. Products shown on the Drawings or specified elsewhere.

C. The Owner will pay for electricity usage. The restrictions on electrical usage shall be as follows:
1. Power tool usage during specified working hours will only be permitted.
2. Dewatering and trash pumps and portable heaters will not be permitted.
3. Power to help cure concrete or painting systems will not be permitted.

1.11 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

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. SED Commissioner's Uniform Safety Standards - Section155.5

B. 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.

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

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 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: WHITE PLAINS HIGH SCHOOL ADDITION Substitution Request Number:_____

Contractor:_____

Address:_____

To:_____ Date:_____

H2M Project Number: WPSD2203 Owner: White Plains City School District

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 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.

1.03 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.

1.04 APPLICATIONS FOR PAYMENT

A. The Contractor shall review the percentage of work completed during the payment period with the Architect/Engineer, based on the bid items in the proposal. The Architect/Engineer shall make the final decision on the percentage of work completed.

B. The form of application for payment shall be AIA Document G702, application and certificate for payment supported by AIA Document G703, Continuation Sheet.

C. Submit one (1) copy of each payment application, completed, signed and notarized.

D. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

E. The payment application shall include a Contractor Invoice and an Owner Claim Voucher.

F. Provide completed Labor Affidavit Form for each pay period included in the certified payroll reports for each payment application for both the contractor and any subcontractor(s).

G. Submit payment application to Architect/Engineer no later than the first day of each month. Payments received after the first day of each month shall be reviewed and processed after the first day of the following month. Only one application for payment will be reviewed and processed each month.

H. Submit certified payroll receipts for all workers and subcontractors. Payroll receipts shall be submitted with every application for payment. All payroll receipts shall be certified correct and notarized by a Notary in the State of New York. Application for Payment will not be processed unless all payroll receipts are received.

I. Contractor shall pay all workers and have all subcontractors pay all workers the prevailing New York State Wage Rates.

J. Owner may conduct on-site interviews with all workers to verify payments of prevailing wage rates are enforced.

K. The Architect/Engineer shall submit the documentation along with an Architect/Engineer’s Payment Report to the Owner for payment.

L. Retainage in the amount of 5% will be held from each partial payment. Retainage will only be released upon full completion of the project and will be included in the final payment.

1.05 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 their copy of the Final Payment Request to them, the Contractor shall return such copy to the Owner together with a statement of their 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.

1.06 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 their 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

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Schedule of Values

1.02 SCHEDULE OF VALUES

A. Submit for approval prior to the start of the work a Schedule of Values that indicates a breakdown of the labor, materials and equipment and other costs used in the preparation of the bid. This schedule shall be in sufficient detail to indicate separate figures for such items as excavation, concrete, equipment and all other items making up the lump sum price. The cost breakdown shall be separately itemized for each lump sum bid item in the project.

B. Where the cost breakdown includes items for bond payment, insurance payment, job set-up, or job mobilization, these items will be paid based on paid invoices and copies of cancelled checks.

C. Submit a Schedule of Values to the Architect/Engineer for review and approval within fifteen (15) calendar days from the date shown on the Notice to Proceed.

1.03 FORM OF SUBMITTAL

A. Submit typewritten Contract Cost Breakdown on AIA Form G703 - Application and Certificate for Payment Continuation Sheet or EJCDC 1910-8-E. The Architect/Engineer reserves the right to revise the form or provide a form prepared by the Architect/Engineer.

B. Use the Table of Contents of the Contract Specifications as a basis for format for listing costs of work for Sections under Divisions 01-48 as sections apply to work. Not all Sections need be assigned a breakout price as determined by the Architect/Engineer.

C. Identify each line item with number and title as listed in Table of Contents.

D. Provide dollar values for each line item for labor, overhead, profit, material, and equipment components for each category of work if requested by the Architect/Engineer.

E. List quantities of materials specified under unit price allowances.

F. The Schedule of Values, after approval by the Architect/Engineer, shall be the basis for the Contractor's Application for Payment.

G. The first Application for Payment will not be reviewed prior to an approved breakdown.

1.04 PREPARATION OF SCHEDULE OF VALUES

A. In addition to the above, provide a separate line item cost for each of the following items which shall be supported by proof where requested by Architect/Engineer:
   1. Performance and payment bonds.
   2. Insurance.
   3. Mobilization and Demobilization (Amounts shall be equal in value).
   4. Temporary facilities and measures as specified in Section 015000.
   5. Project Coordination Meetings as specified in Section 013100.
   6. Preparation of the Project Construction Schedule, and updates, as specified in Section 013216.
   7. Preparation of Weekly Schedules as specified in Section 013100

8. Rubbish removal and daily cleaning up. (Provide a total dollar amount and a daily rate for each calendar day during the contract period.)
9. All Cash Allowance items as contained in Section 012100.
10. On-site, full time superintendent starting on the date of the Notice To Proceed and ending on the date that all punch list items are completed, which for the purposes of the Schedule of Values, shall be the contract completion date.
11. Final cleaning.

B. Show total costs including overhead and profit.

C. Provide additional details and data to substantiate the cost breakdown as 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. 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: White Plains City School District

PROJECT NAME & CONTRACT DESIGNATION: WHITE PLAINS HIGH SCHOOL ADDITION

CONSTRUCTION CONTRACT NO.: WPSD2203

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

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

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 for and 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

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. H2M architects + engineers 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 H2M architects + engineers/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 H2M architects + engineers/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:

H2M architects + engineers
1133 Westchester Avenue, Suite N-210

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 - PROJECT MANAGEMENT AND COORDINATION 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 - PRODUCT SUBSTITUTION PROCEDURES, 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: White Plains City School District
PROJECT TITLE: WHITE PLAINS HIGH SCHOOL ADDITION

H2M PROJECT NO.: WPSD2203

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 Approval Stamp with Signature & Date		Contractor's Brief Comments or Remarks (attach separate letter as needed): 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 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project are the following:

B. 29 CFR 1910 - Occupational Safety and Health Standards; Current Edition.

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

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 speci-fied requirements indicate higher stan-dards 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

SECTION 014500.01

STATEMENT OF SPECIAL INSPECTIONS AND TESTS

NYS EDUCATION DEPARTMENT **Office of Facilities Planning** 89 **Washington Avenue, Room 1060 EBA** **Albany, NY 12234**	**STATEMENT OF SPECIAL INSPECTIONS AND TESTS** As required by the Building Code of NYS (2020 BCNYS) *Note: The code listings below are not to be considered all inclusive.*	
BCNYS § 1704.2.3 requires the NYS Licensed Design Professional (of record) to complete the Statement of Special Inspections and Tests. Completion of the Statement of Special Inspections & Tests, and Submission to the Office of Facilities Planning with the Construction Permit Application is a condition for issuance of the Building Permit.		
School District White Plains City School District	Project Title: WHITE PLAINS HIGH SCHOOL ADDITION	
Building White Plains High School		
SED Project # 66-22-00-01-0-016-030	Project Address White Plains High School, New York, 10605	
Architect/Engineer:		
Sign and Stamp:		
A/E Firm (or Dba) : H2M architects + engineers	Phone	Date
Comments:		

INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17** **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
A. Steel Construction						

INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17** **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
1. Material verification of high-strength bolts, nuts and washers.		X	Applicable ASTM material specifications. AISC 360	1705.2 2204	X	051200
2. Inspection of high-strength bolting.	X	X	AISC 360 ACI 318	1705.2 2204.2	X	051200
3. Material verification of **Structural steel. Open Web Steel Joist and Girders**, Basic protection of steel members, **Seismic Resistance**			AISC 360 ASTM A6, A514, A29 SJ100, 200 AICS 341	1705.2 2203, 2205 1705.2 2207	X	051200 052100
4. Spray Applied Fire Resistant Materials & Specialized Finishes			ASTM E650, E736	1705.14 1705.15		
5. **Cold Formed Steel Construction** - load bearing **Seismic Resistance**			AISI S100, S220, S420 ANSI/SDI-NC1.0, RD1.0, SDI-C, ASCE 7, 8 AISI S400	1704.2.5 2210 2211		
6. Material verification of weld filler materials			AWS D1.1, D1.3	1705.2 2204.1		051200
7. Inspection of welding:			ACI 318: 26.6.4	T 1705.3 2204	X	051200
a. Structural steel	X	X	AWS D1.1, D1.3	1705.2	X	051200
b. Reinforcing steel	X	X	AWS D1.1, D1.3	1705.3.1	X	051200
c. Cold Formed Steel Deck			AISC S100, ASCE7, 8		X	053100
8. Inspection of steel frame joint details.		X		1705.2		051200
B. Concrete Construction				**Ch. 19**		
1. Inspection of reinforcing steel, including prestressing tendons, and verify placement		X	Ch. 21, 22 ACI 318; Ch. 20, 25.2, 25.3, 26.6.1, 26.6.3 AISC 360	T 1705.3 1901 1905	X	033000
2. Inspection of reinforcing steel bar welding			\ACI 318, AWS D1.4	T1705.3		
3. Inspection of anchors to be installed in concrete prior to and during placement	X		ACI 318,17.8.2, 17.8.2.4	T 1705.3		
4. Verify use of required design mix		X	ACI 318; Ch. 19, 26.4.3, 26.4.4	T1705.3 1904 1908	X	033000

INSPECTION AND TESTING Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17 **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
5. Sampling fresh concrete, slump, air content, temperature, strength test specimens.	X		ASTM C172, Ch31 ACI 318: 26.5, 26.9 26.10, 26.11 ASTM C143 ASTMC231 ASTM C1064 ASTM C39	T1705.3 1901 1905 1908	X	033000 0321313:3.10
6. Inspection of placement for proper application techniques.	X		ACI 318: 26.5	T1705.3	X	033000
7. Inspection for maintenance of specified curing temperature and techniques		X	ACI 318: 26.5	T 1705.3 1908 1909		
8. Inspection of prestressed concrete.	X		ACI 318: 26.10	T 1705.3		
9. Erection of precast						
10. Verification of in-situ concrete strength prior to stressing of tendons and prior to removal of shores and forms from beams and slabs.		X	ACI 318: 26.11.2	T1705.3		
11. Inspection of formwork.		X	ACI 318: 26.11.1.2 (b)	T 1705.3		

INSPECTION AND TESTING Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17 **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
C. Masonry Construction				**Ch. 21**		

INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17** **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**		**BCNYS REFERENCE**	**CHECKIRIED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
L1 = Level 1 Inspection required for nonessential facilities. **L2** = Level 2 Inspection required for essential facilities. * In general, schools are not considered essential facilities unless they are a designated emergency shelter.			ASTM E119 UL 263 ASTM C1364 ASTM C1670 ASTM A706 ASCE 7, 8	TMS 402, 403, 404, 504, 602	1705.4 2101 1604		
1. Verify to ensure compliance							
a. Proportions of site prepared mortar and grout.		X L1 L2			1705.4 2103.2		042200
b. Placement of masonry units and construction of mortar joints.		X L1 L2			1705.4 T 1705.3	X	042000
c. Location and placement of reinforcement, connectors, tendons, anchorages.		X L1 L2			1705..45 2103.4 T 1705.3	X	042000
d. Prestressing technique. Grout space prior to grouting	 X L2	X L1 			1705.4 1705.4		
e. Grade and size of prestressing tendons and anchorages Placement of grout	 X L2	X L1 			1705.4 1705.4		
f. Grout specs prior to grouting							
2. Inspection program shall verify:							
a. Size and location of structural elements		X L1 L2			1704.5 1705.4	X	042000
b. Type, size, and location of anchors	X L2	X L1			1705.4 T 1705.3	X	042000
c. Specifies size, grade, and type of reinforcement.		X L1 L2			1704.5	X	042000

INSPECTION AND TESTING Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17 **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**		**BCNYS REFERENCE**	**CHECK IF REQ'D**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
d. Welding of reinforcing bars	X L1 L2				1704.5	X	042000
e. Cold/hot Weather protection of masonry construction		X L1 L2			1704.5 2104.3 2104.4	X	042000
f. Prestressing force measurement and application	X L2	X L1			1704.5		
3. Verification accessory placement prior to grouting	X L2	XL 1			1704.5, 2105.2.2 2105.3		
4 Grout placement	X L1				1704.5	X	
5. Preparation of grout specimens, mortar specimens and/or prisms.	X L1 L2				1704.5, 2105.2.2 2105.3	X	042000
6. Compliance with documents and submittals		X L1 L2			1704.5	X	042000

INSPECTION AND TESTING Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17 **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQ'D**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
D. Wood Construction				**Ch. 23**		
1. Fabrication process of prefabricated **Wood Structural Elements** and assemblies.		X	Ch. 16 AWC, APA, CPA DOC PS1, PS2	1704.6 1705.5 2302, 2303 2304		033000

INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17** **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
2. High-load diaphragms **Seismic Resistance**		X		1704 1705 1704.6 2304 2305 2306, 2307, 2308		
E Soils				Ch. 18		
1. Geotechnical Investigations, Excavations, Grading, Fill Damp-proofing Water-Proofing		X	ASTM E329, ASTM D3740, ASTM E548, NYS DOT OSHA Appendix J - BCNYS	1704, 1706 1803, 1804, 1805	X	312000
2. **Flood & Stormwater Hazards** (per BCNYS 106)		X	Local Highway Authority Flood Plain Admin. Appendix G - BCNYS	1705.12 - 1705.12.9		
F. Specialized Foundations, Piers, Piles				**Ch. 16**		
1. Deep Foundations Driven Piles Cast-in Place Helical Piles		X		T 1705.7 T1705.8 1705.7 1705.8 1705.9		
G. Exterior Wall Coverings				**Ch. 14**		
1. Exterior Insulation and Finish Systems (EIFS) MCM, HPL, Other Combustible Materials		X	ASTM E2568, E2273, E2570, E2393, E84 Ch. 16 NFPA 268, 275, 285,286	1405, 1406, 1407, 1408 1704.2 1705.12.5 1705.16		
H. Miscellaneous						
1. Access Floors and Storage Racks Other Architectural, MEP Components **Seismic Resistance**		X		1705.12		
2. In-Situ Testing		X		1604.6 1708		

INSPECTION AND TESTING **Continuous & Periodic is as Defined by the BCNYS - CHAPTER 17** **All reports to be submitted to the Owners Representative for use, approval , and record.**	**CONTINUOUS**	**PERIODIC**	**REFERENCE STANDARD**	**BCNYS REFERENCE**	**CHECK IF REQUIRED**	**IDENTIFY SPEC SECTION AND PROVIDE CLARIFYING NOTES IF NECESSARY**
3. Pre-construction Load Testing		X		1604.7 1709		
4. Fire Resistant Penetrations & Joints Fire Stops Testing for Smoke Control		X	Ch. 7 ASTM E119 Ul263	1705.17 1705.18		
5. **Pre-Submission:** **Inventory of all Fire-Resistant-Rated Construction - Level 2 Alterations and greater** (per BCNYS 106)	X		verification required EBNYS Ch.3 C. of E. 155 Regulations	**FCNYS 701.6** **BCNYS 703.7** 19CRRNY XXXII		
6. **Pre-Submission:** **Hazardous Material Survey** **Water Quality Survey**	X X		verification required ACM Letter - Certificate C.of E. 155 Regulations	US-EPA NYS-DOH		
7. Other:						

END OF SECTION

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.

2.03 TEMPORARY FACILITIES

A. Field Offices: Prefabricated units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Owner/CM/Architect Field Office: The Prime Contract for General Construction shall furnish and equip offices at the White Plains High School as follows:

C. FIELD OFFICES / TRAILERS
   1. Field Offices: Prefabricated units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
   2. Owner/CM/Architect Field Office: General Construction Contract shall furnish and equip offices at the Project site.
      a. Provide 12’x 60’w/ hitch, Office by Williams Scotsman for use by Owner/Construction Manager/Architect personnel engaged in construction activities.
         1) Office trailer must have toilet facilities and sink, contractor needs to maintain/service the toilet for the duration of the project at Owner/CM/Architect trailer.
         2) The trailer shall have a lactation room minimum 4’x6’ with a countertop and a receptacle in the room. The lactation room door shall have a lock and there shall be a supply air louver connected to the ventilation system
         3) The Trailer is to be tied down and fully skirted.
         4) The trailer location will be as directed by the Owner and CM.
      b. Trailer to have exterior lighting
      c. Provide (1) High speed internet service with wireless router and Ethernet Switch
      d. Provide the following new equipment which shall become the property, excluding the Multifunction Printer, of the Owner at the end of the project.
         1) May-line Pivot Wall Rack with 24 Racks (Installation by GC) or
         2) standing type.
         3) Laser Color Multifunction printer/copier/fax/scanner with 11x17 paper tray with Network capability by Ricoh standalone unit or equal, (provide ink and paper supplies for the project duration) to include 24 hour on call servicing
         4) (1) 4 Drawer File Cabinet heavy duty
         5) (3) Wall Mounted Shelves (6’x14”) Installation by GC.
         6) (2) Tack boards 36” x 48” Installation by GC
         7) (2) White boards 36” x 48” with erasers and markers, installation by GC

8) (3) Desk (66"W x 30"D x 29-1/2"H) w/ (4) Padded Swivel Manager Desk Chair (Staples® Carder Ergonomic Fabric Swivel Computer and Desk Chair, Black 24115-CC)
9) (1) Large trash container (32 gal) and (3) small trash container (13 gal) (provide bags for project duration and weekly cleanup of trailer)
10) (3) Conference Table (30"W x 72"L x 29"H)
11) (12) Vinyl Padded Folding Chairs
12) (1) Cold/Hot water dispenser (provide delivery service for project duration)
13) (1) 3.6 Cu. Ft. Refrigerator w Freezer
14) (1) 0.7 Cu. Ft. Microwave Oven
15) (1) First aid kit - Global Industrial First Aid Kit - 3 Shelf Steel Cabinet, ANSI Compliant, 75-100 Person
16) (2) Fire Extinguisher- shall be UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

e. Security System, 2 wireless cameras, one camera installed opposite each entry door that records entry and movement in the trailer and signals an alarm. .
f. Drinking water and private toilet.
g. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg. F (20 to 22 deg. C).
h. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
i. Owner/CM Field office shall be secured and be provided with completing skirting around perimeter.
j. Owner/CM Field office to be swept, mopped and toilet facilities sanitized weekly
k. Provide security bars at doors and security screens at all windows.
l. Provide stairs at each door.
m. Provide Three-inch (3) gravel base, for area at Owner trailer area as per CM direction.
n. Provide (2) Two heavy duty master locks with (4) four keys

3. The Electrical Contract for CONTRACT WHITE PLAINS HIGH SCHOOL Contract 1 EC: Electrical shall provide power to the Owner/CM/Architect Field Office at the White Plains High School.

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 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 - PROJECT MANAGEMENT AND COORDINATION 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

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 - PROJECT RECORD DOCUMENTS.
   2. Operations and Maintenance Manuals prepared in accordance with Section 017823 - OPERATING AND MAINTENANCE DATA 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 - <u>100% of contract including change orders</u>
   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 - STARTING AND ADJUSTING 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

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. 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 - SUBMITTALS.

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

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.

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. Photographs or Video: Submit before Work begins.

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

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

1.07 CLOSEOUT SUBMITTALS

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

B. 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 011000 "Summary."

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. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
   1. Building Structure and Shell: 75 percent.
   2. Nonshell Elements: 50 percent.
   3. Nonshell Elements: 40 percent.

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

D. 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

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Formwork, shoring, bracing and anchorage.

B. Concrete reinforcement and accessories.

C. Cast-in-place concrete, equipment pads.

D. Concrete curing and finishing.

E. Grout.

1.02 RELATED SECTIONS

A. Section 014500 - QUALITY CONTROL.

1.03 REFERENCES

A. ACI 301 - Specifications for Concrete Construction; 2020.

B. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

C. ACI 305R - Guide to Hot Weather Concreting; 2020.

D. ACI 308R - Guide to External Curing of Concrete; 2016.

E. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).

F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

H. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2019.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

J. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

K. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

L. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

N. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2022.

O. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

P. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.

Q. CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300 - SUBMITTALS.

B. Shop Drawings: Indicate reinforcement sizes, spacings, and locations of reinforcing steel and wire fabric, bending and cutting schedules, splicing, and supporting and spacing devices. Indicate formwork dimensioning, materials, arrangement of joints and ties.

C. Design Data: Provide a concrete mix design for each type of concrete to be utilized on the project prior to commencement of work. The Contractor's testing laboratory shall develop concrete mix designs and test all materials and mixes for conformance with these specifications. The costs associated with development of the design mix and testing of samples shall not be paid out stipulated cash allowance and shall be included in the bid price.

D. Furnish the Engineer's field representative with transit-mix delivery slips.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Maintain one copy of document on site.

C. Concrete Testing Service: Engage a testing laboratory acceptable to the Architect/Engineer to perform material evaluation tests and to design concrete mixes under provisions of Section 014500 - QUALITY CONTROL.

D. For each mix proposed, make and cure four (4) standard 6 inch concrete test specimens in the lab in accordance with ASTM C192. Furnish compression test results made in accordance with ASTM C39/C39M. Break two (2) cylinders at seven (7) days and two (2) at twenty-eight (28) days.

1.06 QUALIFICATIONS

A. Prepare shop drawings under seal of professional structural engineer licensed in the state in which the project is located.

1.07 REGULATORY REQUIREMENTS

A. Conform to ACI 301 and all applicable codes for placement of concrete and related work.

1.08 COORDINATION

A. Coordinate work prior to commencement of work.

B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.

C. Notify Engineer minimum 72 hours prior to commencement of concreting operations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conform to .

B. Plywood Forms: Douglas Fir species; solid one side grade; sound undamaged sheets. Thickness of wood shall be as required to support weight of concrete with minimal deflection.

C. Steel Forms: Minimum 16 gage (1.5 mm) thick, stiffened to support weight of concrete with minimum deflection.

D. Tubular Column Type Forms: Round, spirally wound laminated fiber material; inside surface treated with release agent.

E. Form Ties: Snap-off metal, of fixed length, cone ends.

F. Reinforcing: ASTM A615/A615M, 60 ksi (414 MPa) yield grade billet steel deformed bars; uncoated; size and dimensions as indicated on the plans.

G. Welded Steel Wire Fabric: Plain type, ANSI/ASTM A185; in flat sheets; size and dimensions as indicated on the plans.

H. Cement: ASTM C150, Type I - Normal.

I. Fine and Coarse Aggregates: ASTM C33.

J. Water: Clean and not detrimental to concrete.

2.02 ACCESSORIES

A. Air Entraining Admixture: ASTM C260.

B. Chemical Admixture: ASTM C494, Type as required.

C. Bonding Agent: Polymer resin emulsion manufactured by SPECCO INDUSTRIES, INC., or specifically approved equal.

D. Vapor Barrier: ASTM C1745, 6 mil (0.15 mm) thick clear polyethylene film.

E. Non-Shrink Grout: Premixed compound with non-metallic aggregate, cement, water reducing and plasticizing agents; capable of minimum compressive strength of 2400 psi (16.5 MPa) at 48 hours and 7000 psi (48.3 MPa) at 28 days.

F. Expansion Joints: ASTM C1063; 1/2 inch (13 mm) thick asphalt impregnated fiberboard or felt.

G. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete; manufactured by SPECCO INDUSTRIES, INC. or specifically approved equal. Agent shall not be detrimental to the environment.

H. Sealant: ASTM D1190; hot applied rubber compound manufactured by THE BURKE COMPANY or specifically approved equal.

I. Absorptive Mat: Burlap-polyethylene, 8 oz/sq yd (270 g/sq m), bonded to prevent separation during use.

J. Membrane Curing Compound: ASTM C1315, Type 2, Class A.

K. Clear Sealer: Siloxane type; manufactured by THE BURKE COMPANY or specifically approved equal.

2.03 MIXES

A. Mix concrete in accordance with ASTM C94, Alternative No. 2, to achieve the following:
   1. Compressive Strength (28 day): 4,000 psi
   2. Slump:
      a. 3 +/-1 inches (initial/conventional mix)
      b. 7 +/-1 inches (final/pump mix)
   3. Air Entrainment: 5 ½ +/-1 percent
   4. Water/Cement Ration: 0.50 maximum
   5. Large Aggregate: ¾" crushed stone, ASTM C33, No. 67

B. Use admixtures only when approved by the Engineer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to commencement of work.

B. Verify lines, levels, and measurement before proceeding with formwork. Ensure that dimensions agree with the plans.

3.02 PREPARATION

A. Hand trim sides and bottom of earth forms; remove loose dirt.

B. Align form joints.

C. Do not apply form release agent where concrete surfaces are to receive special finishes or applied coatings which may be affected by the agent.

D. Where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels and pack with non-shrinking grout.

E. Prepare previously placed concrete by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Place, support, and secure reinforcement against displacement at the locations and to the dimensions as indicated on the plans.

B. Use reinforcing splices at a minimum of locations and only at locations of minimum stress. Review locations of splices with Engineer.

C. Splice overlap shall be a minimum length of 40 diameters.

D. Ensure reinforcement, inserts, embedded parts, formed joint fillers, joint devices and waterstops are not disturbed during concrete placement.

E. Install joint fillers in accordance with manufacturer's instructions.

F. Extend joint filler from bottom of slab to within 1/2 inch (13 mm) of finished slab surface.

G. Install joint devices in accordance with manufacturer's instructions.

H. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

I. Place concrete continuously between predetermined expansion, control and construction joints.

J. Do not interrupt successive placement; do not permit cold joints to occur.

3.04 INSTALLATION - SLABS

A. Place slabs in checkerboard pattern.

B. Saw cut control joints at an optimum time after finishing. Cut slabs with 3/16 inch (4.8 mm) thick blade, cutting 1/4 of depth of slab thickness.

C. Separate slabs on grade from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within 1/4 inch (6 mm) of finished slab surface.

D. Steel trowel all surfaces except as noted.

E. Cure floor surfaces in accordance with ASTM C31.

F. Apply curing compound in accordance with manufacturer's instructions in 2 coats with second coat at right angles to the first.

3.05 TOLERANCES

A. Equipment Pads: Provide Class B tolerance to floor slabs according to ASTM E1155.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing of concrete will be performed under provisions of Section 014500 - QUALITY CONTROL.

B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ASTM C31.

C. Four concrete test cylinders will be taken for every 50 cu yds, or fraction thereof, for each class of concrete placed each day.

D. One additional test cylinder will be taken during cold weather and be cured on site under same conditions as concrete it represents.

E. One slump test will be taken for each set of test cylinders taken.

3.07 PROTECTION

A. Protect finished work until completion of project.

B. Protect concrete from damage and deformation until project is accepted by the Owner.

3.08 SCHEDULE: CONCRETE FINISHES

A. Equipment Pads: Broom finish, trim edge.

B. All Other Finishes: Steel trowel surface, unless otherwise noted.

END OF SECTION

PART 1 - GENERAL

1.01 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.

1.02 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 A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

L. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2022.

M. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2019.

N. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2021.

O. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete; 2010a (Reapproved 2015).

P. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

Q. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

R. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

S. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete; 2017.

T. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

U. ASTM C192/C192M - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory; 2019.

V. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

W. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

X. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2022.

Y. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

Z. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.

AA. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

AB. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2022.

AC. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2022.

AD. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2022.

AE. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.

AF. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.

AG. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications; 2016.

AH. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012 (Reapproved 2017).

AI. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

AJ. 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.

AK. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 2017.

AL. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).

AM. PS 1 - Structural Plywood; 2009 (Revised 2019).

AN. ACI 350 - Concrete Sanitary Engineering Structures.

AO. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

1.03 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.

1.04 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.

1.05 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.

1.06 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.

1.07 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.

1.08 REGULATORY REQUIREMENTS

A. Conform to ACI 304R and all applicable codes for placement of concrete and related work.

1.09 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 - NON-PENETRATING ROOFTOP SUPPORT SYSTEMS.

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.
3. For Concrete Tanks: Furnish snap-ties with 1 inch plastic cone and waterseal washer.

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 079200 - JOINT SEALANTS 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, 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 within 72 hours of finishing.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid-applied self-leveling floor underlayment.
   1. Cementitious type.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.

C. ASTM C348 - Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

F. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.03 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

C. Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Instructions.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F (41 degrees C).

1.06 MOCK-UP

A. Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Prepare mock-up in location designated by Architect/Engineer.
   2. Area: 6 ft by 6 ft (2 m by 2 m).

3. Do not proceed with underlayment work until workmanship of mock-up has been approved by Architect/Engineer.

B. Mock-up may remain as part of the Work.

1.07 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) 24 hours before, during and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cementitious Underlayment: (FIN-CONC)
1. ARDEX Engineered Cements: ARDEX K 520: www.ardexamericas.com/#sle.
2. Custom Building Products; CL-150 Self-Leveling Underlayment: www.custombuildingproducts.com/#sle.
3. Maxxon Corporation; Level-One EZ: www.maxxon.com/#sle.
4. MAPEI Corp.; Novoplan 2 Plus (standard set) or Ultraplan 1 Plus (rapid set) with Primer T: www.mapei.com
5. UZIN, a division of UFLOOR Systems Inc; UZIN PE 260 primer with UZIN NC 170 LevelStar: www.ufloorsystems.com/#sle.
6. W. R. Meadows, Inc; Floor-Top STG: www.wrmeadows.com/#sle.

2.02 MATERIALS

A. Cast Underlayments, General:
1. Comply with applicable code for combustibility or flame spread requirements.
2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.

B. Cementitious Underlayment: Blended cement mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
1. Compressive Strength: Minimum 5000 pounds per square inch (34.5 MPa) after 28 days, tested per ASTM C109/C109M.
2. Flexural Strength: Minimum 1000 psi (6.9 MPa) after 28 days, tested per ASTM C348.
3. Density: 125 pounds per cubic foot (2002 kg/cu m), nominal.
4. Final Set Time: 1-1/2 to 2 hours, maximum.
5. Thickness: Capable of thicknesses from feather edge to maximum 3-1/2 inch (89 mm).
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.

C. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch (3 mm) in size and acceptable to underlayment manufacturer.

D. Reinforcement: Galvanized metal lath complying with recommendations of underlayment manufacturer for specific project circumstances.

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.

F. Primer: Manufacturer's recommended type.

G. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.

2.03 MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 1/2 inch (12.7 mm). Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

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. Concrete: Prepare surfaces according to ICRI 310.2R, CSP 6 (medium scarification)

E. Wood: Install metal lath for reinforcement of underlayment.

F. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

G. Vacuum clean surfaces.

H. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

I. Close floor openings.

3.03 APPLICATION

A. Install underlayment in accordance with manufacturer's instructions.

B. Pump or pour material onto substrate. Do not retemper or add water.

1. Pump, move, and screed while the material is still highly flowable.
2. Be careful not to create cold joints.
3. Wear spiked shoes while working in the wet material to avoid leaving marks.

C. Place to indicated thickness, with top surface level to 1/16 inch in 10 ft (1:2000).

D. For final thickness over 1-1/2 inches (38 mm), place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.

E. Place before partition installation.

F. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.

G. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.04 CURING

A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.

B. Air cure in accordance with manufacturer's instructions.

3.05 FIELD QUALITY CONTROL

A. An independent testing agency will perform field inspection and testing, as specified in Section 014000 - Quality Requirements.

B. Placed Material: Agency will inspect and test for compliance with specification requirements.

3.06 PROTECTION

A. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.

B. Do not permit traffic over unprotected floor underlayment surfaces.

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. Concrete masonry units.
   2. Mortar and grout.
   3. Steel reinforcing bars.
   4. Masonry joint reinforcement.
   5. Miscellaneous masonry accessories.
   6. Installation of Door Frames, Lintels and items furnished by other sections.
   7. Cleaning of masonry.

1.03 DEFINITIONS

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

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

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

C. Samples for Initial Selection:
1. Colored mortar.
2. 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. Reinforcing bars.
6. Joint reinforcement.
7. 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 C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.
   2. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.
   3. 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. Reinforcing, flashing, control joint and sealant installations;
      f. 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.

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. Epoxy coated reinforcement shall conform to ASTM A775/A775M.

C. 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.

D. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

2.05 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.

2.06 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.

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

E. 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.

F. 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.

2.08 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 078446 - FIRE-RESISTIVE JOINT SYSTEMS.

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 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 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.

3.08 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.

3.09 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 079200 - JOINT SEALANTS 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.

3.10 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.

3.11 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.

D. Steel reinforcement bars, unless otherwise detailed on plans, shall be placed as follows:
   1. Install #5 bar, vertically at all corners and at door and window jambs and 32" o.c. typical in all 10" walls.
   2. Install #5 bar, vertically at all corners and at door and window jambs and 48" o.c. typical in all 12" walls.
   3. Fill all concrete masonry unit cells containing reinforcement bars solid with mortar.
   4. Remove pre-molded insulation from block cores containing vertical reinforcing bars.
   5. Reinforcement Bars shall be lapped at splices as follows:

Bar Size	**Min. Lap Distance**
#4	24 inches
#5	30 inches
#6	36 inches
#7	42 inches

3.12 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.

3.13 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.

3.14 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.

3.15 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 - FILL.
   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

PART 1 GENERAL

1.01 SUMMARY

A. Limestone adhered veneer (units size thickness ranging from a minimum ¼ inch (6mm) up to a maximum 2-5/8 inches (65mm) in accordance with IBC – Chapter 14 Exterior Walls or applicable local building codes for thin adhered masonry veneer), veneer installation materials and accessories.

1.02 SECTION INCLUDES

A. Thin Adhered dolomitic limestone veneer at exterior walls.

B. Metal anchors and supports.

C. Sealing exterior joints.

D. Air and Water Barriers

1.03 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2019.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

D. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022.

E. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2019.

F. ASTM C568/C568M - Standard Specification for Limestone Dimension Stone; 2022.

G. ASTM D2394 - Standard Test Methods for Simulated Service Testing of Wood and Wood-Based Finish Flooring; 2017.

1.04 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Provide data on stone, mortar products, and sealant products.

C. Shop Drawings: Indicate layout, pertinent dimensions, anchorages, head, jamb, and sill opening details, and jointing methods.

D. Samples: Submit three (3) stone samples 3 inches by 3 inches in size, illustrating color range and texture, markings, surface finish, and sheen.

E. Installation Instructions: Submit stone fabricator's installation instructions and field erection or setting drawings; indicate panel identifying marks and locations on setting drawings.

F. Submit sample of installation system demonstrating compatibility/functional relationships between air barriers, waterproofing membranes, adhesives, mortars pointing mortars and other components under provision of Section 013300 - SUBMITTALS.

G. Stone Fabricator's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

A. Adhered Masonry Veneer (single source responsibility): Company specializing in adhered masonry veneer, trim units with Five (5) years minimum experience. Obtain adhered masonry veneer from a single source with resources to provide products of consistent quality in appearance and physical properties.

B. Installation System Manufacturer (single source responsibility): Company specializing in air barriers, waterproofing membranes, adhesives, mortars pointing mortars and other installation materials with ten (10) years minimum experience and ISO 9001 certification. Obtain installation materials from single source manufacturer to insure consistent quality and full compatibility.

C. Submit positive laboratory testing to confirm applicability of air barrier, waterproofing membranes, adhesives, mortars pointing mortars, and other installation materials for specified job conditions.

D. Installer qualifications: company specializing in installation of adhered masonry veneer and trim units with five (5) years documented experience with installations of similar scope, materials and design.

1.06 MOCK-UP

A. Construct stone wall mock-up of each type/style/finish/size/color of adhered masonry veneer and trim unit, including stone adhesives, anchors, accessories, sill and head flashings, window frame, corner condition, typical control joint, and pointing / tooling of joints..

B. See Section 014500 - QUALITY CONTROL for additional requirements.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver Limestone units in protective film. Prevent damage to units.

B. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.

C. Store units in a manner designed to prevent damage and staining of units.

D. Stack units on timbers or platforms at least 3 inches above grade.

E. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.

F. Cover stored units with protective enclosure if exposed to weather.

G. Do not use salt or calcium-chloride to remove ice from masonry surfaces.

H. Store adhered masonry veneer and installation system materials in a dry location; handle in a manner to prevent chipping, breakage, and contamination.

I. Protect latex additives, liquid air barriers, waterproofing membranes, epoxy adhesives and sealants from freezing or overheating in accordance with manufacturer's instructions; store at room temperature when possible.

J. Store portland cement mortars and pointing mortars in a dry location.

1.08 FIELD CONDITIONS

A. Provide ventilation and protection of environment as recommended by manufacturer.

B. Prevent carbon dioxide damage to adhered masonry veneer, trim, as well as adhesives, liquid air and water barrier ,mortars, pointing mortars and other installation materials, by venting temporary heaters to the exterior.

C. Maintain ambient temperatures not less than 37ºF (3ºC) or more than 100ºF (38ºC) during installation and for a minimum of seven (7) days after completion. Setting of portland cement is retarded by low temperatures.
   1. Protect work for extended period of time and from damage by other trades.
   2. Epoxy mortars and epoxy pointing mortars require surface temperatures between 60ºF (16ºC) and 90ºF (32ºC) at time of installation.
   3. Liquid air barrier and waterproofing Membranes require surface temperatures between 50ºF (10ºC) and 90ºF (32ºC). It is the General Contractor’s responsibility to maintain temperature control.

D. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

1.09 SEQUENCING AND SCHEDULING

A. Coordinate installation of adhered masonry veneer work with related work.

B. Proceed with adhered masonry veneer work only after curbs, vents, drains, piping, and other projections through substrate have been installed .

1.10 WARRANTY

A. Thin Adhered Limestone installed over Concrete or Concrete masonry unit substrate:
   1. The Contractor warrants the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for a period of twenty-five (25) years. The manufacturer of adhesives, liquid air and water barrier, mortars, pointing mortars and other installation materials shall provide a written twenty-five (25) year warranty, which covers materials and labor.

1.11 MAINTENANCE MATERIALS

A. Extra stock is to be from same production run or batch as original adhered masonry veneer and installation materials.

B. Upon completion of the work of this Section, deliver to the Owner 2% minimum additional adhered masonry veneer and trim shapes or a minimum of 2 additional pieces of each type, color, pattern and size used in the Work, as well as extra stock of adhesives, mortars, pointing mortars and other installation materials for the Owner's use in replacement and maintenance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers of Limestone units having Products considered acceptable for use:
   1. Arriscraft International , as distributed by [_____]].[_____]; Adair® Limestone Marble.
   2. Architect approved equivalent.
   3. See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES.

B. Manufacturers of Adhered Masonry Veneer Installation Materials and Accessories having Products considered acceptable for use:
   1. Laticrete International [, as distributed by [_____]].
   2. Architect approved equivalent.
   3. See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES.

2.02 ADHERED MASONRY VENEER MATERIALS

A. Dolomitic Limestone: ASTM C568/C568M, Category III - High-Density: >2,560 kg/m3; special shapes as indicated; having the following typical average properties when tested to the identified standard
   1. Compressive Strength: 158 MPa, to ASTM C170.
   2. Absorption: 0.75 percent, to ASTM C97.
   3. Density: 2,675 kg/m3, to ASTM C97.
   4. Modulus of Rupture: 15.5 MPa, to ASTM C99.
   5. Flexural Strength: 11.0 MPa, to ASTM C880.
   6. Abrasion Resistance: 18.0 to ASTM C241.

2.03 FABRICATED UNITS

A. Stone Panels: dolomitic limestone panels, as described below:
   1. Bed Thickness: 1 inch thick;
   2. Panel Sizes: modular sizes as indicated or scheduled on the drawings.
   3. Finish: As indicated on the drawings Provide finish on exposed faces and ends.
   4. Color: as selected by the Architect.
   5. Pattern: as selected by the Architect.

B. Sills and Trim: Dolomitic limestone units, sizes and profiles as indicated on Drawings.
   1. Finish: As indicated on the drawings. Provide finish on exposed faces and ends.
   2. Color: as selected by the Architect .
   3. Pattern: as selected by the Architect.

2.04 CEMENT BOARD

A. Backer Board: Cementitious, water durable, board; surfaced with fiberglass reinforcing mesh on front and back; long edges wrapped; and complying with ANSI A118.9 and ASTM C1325. (PermaBase BRAND Cement Board or Architect approved equivalent).
   1. Thickness: 5/8 inch.
   2. Width: 2 feet- 8 inches, 3 feet, and 4 feet.
   3. Length: 4 feet, 6 feet, and 8 feet.
   4. Edges: Tapered.
   5. Compressive Strength: Not less than 2250 lbs. per sq. in. when tested in accordance with ASTM D2394.
   6. Water Absorption: Not greater than 8 percent when tested for 24 hours in accordance with ASTM C473.

B. Fasteners:
   1. Screws (for wood or 22 gauge or lighter gauge steel framing): Hi-Lo thread screws (No. 8) wafer head, corrosion-resistant, 1 1/4 inches, 1 5/8 inches, and 2 1/4 inches in length, and complying with ASTM C1002.
   2. Screws (for steel framing heavier than 22 gauge): Drill point screws (No. 8) wafer head, corrosion-resistant, 1 1/4 inches, 1 5/8 inches, and 2 1/4 inches in length, and complying with ASTM C1002.

C. Joint Treatment:
   1. Tape: Alkali-resistant fiberglass mesh tape intended for use with cement board.

D. Bonding Materials:
   1. Mortar: Latex-portland cement mortar in accordance with ANSI A118.4.

2.05 ADHERED MASONRY VENEER INSTALLATION MATERIALS AND ACCESSORIES

A. Air and Water Barrier Membrane: LATICRETE® Air & Water Barrier or Architect approved equivalent, to be thin, cold applied, single component liquid and load bearing. Waterproofing Membrane to be non-toxic, non-flammable, and non-hazardous during storage, mixing, application and when cured:

1.	Air Barrier Test (AC 212):	Pass
2.	Air Permeance (ASTM E2178):	Pass
3.	Elongation @ break (ASTM D751):	20-30%
4.	7 day Tensile Strength (ANSI A118.10):	>265 psi (1.8 MPa)
5.	7 day Shear Bond Strength (ANSI A118.10)	>200 psi (1.4 MPa)
6.	28 Day Shear Bond Strength (ANSI A118.4):	>214 psi (1.48 – 2.4 MPa)
7.	Service Rating (TCA/ASTM C627):	Extra Heavy
8.	Total VOC Content:	< 0.05 mg/m3

B. Epoxy Waterproofing Flashing Mortar: LATAPOXY® Waterproof Flashing Mortar or Architect approved equivalent, to be 3 component epoxy, trowel applied specifically designed to be used under adhered masonry veneer:

1.	Breaking Strength (ANSI A118.10):	450-530 psi (3.1-3.6 MPa)
2.	Waterproofing Capability (ANSI A118.10):	No Water penetration
3.	7 day Shear Bond Strength (ANSI A118.10):	110-150 psi (0.8-1 MPa)
4.	28 Day Shear Bond Strength (ANSI A118.10):	90-120 psi (0.6–0.83 MPa)
5.	12 Week Shear Bond Strength (ANSI A118.10):	110-130 psi (0.8-0.9 MPa)
6.	Total VOC Content:	<3.4 g/L

C. Cementitious backer board units: size, thickness and installation as specified by cement backer board manufacturer, complying with ANSI A118.9.

D. Latex-Portland Cement Mortar for leveling beds and scratch/plaster coats: LATICRETE Premium Mortar Bed to meet the following physical requirements:

1.	Compressive Strength (ANSI A118.4 Modified):	>4000 psi (27.6 MPa)
2.	Water Absorption (ANSI A118.6):	5% or less
3.	Service Rating (TCA/ASTM C627):	Extra Heavy
4.	Smoke & Flame Contribution (ASTM E84 Modified):	0
5.	Total VOC Content:	< 0.05 mg/m3

E. Latex Portland Cement Mortar: LATICRETE Hi Bond Masonry Veneer Mortar ** to be weather, frost, shock resistant, non-flammable and meet the following physical requirements:

1.	Compressive strength (ANSI A118.4):	>2500 psi (17.2 MPa)
2.	Bond strength (ANSI A118.4):	>450 psi (3.1 MPa)
3.	Smoke & Flame Contribution (ASTM E84 Modified):	0
4.	Total VOC Content:	< 0.05 mg/m3

F. Latex Portland Cement Pointing Mortar / Grout: LATICRETE Premium Masonry Pointing Mortar ** to be weather, frost and shock resistant, as well as meet the following physical requirements:

1.	Compressive Strength (ANSI A118.7):	4500 psi (31 MPa)
2.	Tensile Strength (ANSI A118.7):	>500 psi (3.45 MPa)
3.	Flexural Strength (ANSI A118.7):	>1250 psi (8.6 MPa)
4.	Water Absorption (ANSI A118.7):	< 5%
5.	Linear Shrinkage (ANSI A118.7):	< 0.05 %
6.	Smoke & Flame Contribution (ASTM E84 Modified):	0
7.	Total VOC Content:	< 0.05 mg/m3

G. Expansion and Control Joint Sealant: LATICRETE Latasil™ to be a one component, neutral cure, exterior grade silicone sealant and meet the following requirements:

1.	Tensile Strength (ASTM C794):	280 psi (1.9 MPa)
2.	Hardness (ASTM D751; Shore A):	25 (colored sealant) /15 (clear sealant)
3.	Weather Resistance (QUV Weather-ometer):	10000 hours (no change)

H. Spot Bonding Epoxy Adhesive: LATAPOXY 310 Stone Adhesive (Standard or Rapid Grade) for installing adhered masonry veneer, brick and stone over vertical surfaces shall be high strength, high temperature resistant, non-sag and shall meet the following physical requirements:

1.	Thermal Shock Resistance (ANSI A118.3):	>1000 psi (6.9 MPa)
2.	Water Absorption (ANSI A118.3):	0.1 %
3.	Compressive Strength (ANSI A118.3):	>8300 psi (57.2 MPa)
4.	Shear Bond Strength (ANSI A118.3 Modified):	>730 psi (5 MPa)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that support work and site conditions are ready to receive work of this section.

B. Inspect materials for fit and finish prior to installation. Do not set unacceptable units.

C. Verify that items built-in under other sections are properly located and sized.

3.02 CUTTING MASONRY UNITS

A. Cut masonry units with wet-saw.

B. Pre-soak units using clean water prior to cutting.

C. Clean cut units using a stiff fibre brush and clean water. Allow units to surface dry prior to placement.

D. Finish cut edges to match face when exposed in wall.

3.03 COURSING

A. Place masonry to lines and levels indicated.

B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.

C. Lay masonry units in bond indicated on the drawings.

D. Course one masonry unit and one mortar joint to equal 12 inches. [OR] Maintain mortar joint thickness of 3/8 inch.

E. Tool joints when thumbprint hard, to a flush finish.

3.04 FIELD QUALITY CONTROL

A. Perform inspection and testing as specified in Section 014500 - QUALITY CONTROL.

B. Inspection:
   1. Masonry will be free of cracks or other blemishes on the finished face or front edges of the masonry units exceeding 3/8 inch or that can be seen from a distance of 10 feet.
   2. Units shall exhibit a texture approximately equal to the approved sample when viewed under diffused daylight illumination at a 20 foot distance.
   3. Minor chipping resulting from shipment and delivery shall not be obvious under diffused daylight illumination from a 20 foot distance.
   4. Remove Efflorescence in accordance with the manufacturer's recommendations.

3.05 ADJUSTING AND CLEANING

A. Repair minor chips on smooth finished units in strict accordance with the manufacturer's instructions.

B. Clean one-half of the mock-up panel as directed below and leave for one week. If no harmful effects appear and mortar has set and cured, clean installed masonry as follows:
   1. Protect windows, sills, doors, trim and other work from damage.
   2. Remove large particles with stiff fiber brushes or wood paddles without damaging surfaces.
   3. Saturate masonry with clean water and flush off loose mortar and dirt.
   4. Dilute cleaning agent with clean water in controlled proportions.
   5. Apply solution to pre-soaked wall surface using soft-bristled brushes or low pressure acid-resistant sprayer.
   6. Thoroughly rinse cleaning solution and residue from wall surface.

3.06 PROTECTION

A. Protect units from damage resulting from subsequent construction operations.

B. Use protection materials and methods which will not stain or damage units.

C. Remove protection materials upon Substantial Completion, or when risk of damage is no longer present.

3.07 INSTALLATION

A. Set stone with a consistent joint width of 3/8 inch (9 mm).

3.08 TOLERANCES

A. Positioning of Elements: Maximum 1/4 inch (6 mm) from true position.

B. Maximum Variation Between Face Plane of Adjacent Panels: 1/16 inch (1.5 mm).

C. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet (3 mm/m).

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. 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 A307, Grade C for non-moment resisting anchor rods. 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 2020 New York State Building Code 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 SECTION INCLUDES

A. Structural cast steel components including:
   1. Universal pin connectors.
   2. Architectural tapers.
   3. Universal pin connectors and architectural tapers, where used together.

1.02 REFERENCES

A. AISC 341 - Seismic Provisions for Structural Steel Buildings; 2016 (Revised 2020).

B. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

1.03 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Casting material test reports and non-destructive test reports.

C. Welding Procedure Specifications (WPS) prepared in accordance with AISC 360 Chapter N shall be developed by the Steel Fabricator for the welded joints between the steel castings and the attaching structural steel elements.

1.04 QUALITY ASSURANCE

A. Casting Inspector Qualifications: in accordance with American Society for Nondestructive Testing, Inc. (ASNT), TC-1A, or equivalent independent qualified agency.

B. Manufacturer Qualifications: Specializing in structural cast steel components and having demonstrable experience in engineering, detailing, and supplying structural steel castings of a similar size as required for this project and for use in architecturally exposed structural steel. Member of the following organizations:
   1. Associate Member of the American Institute of Steel Construction.
   2. Affiliate Member of the National Council of Structural Engineers Associations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle materials to avoid damage. Protect materials from corrosion, deterioration, and damage.

1.06 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.07 COORDINATION OF TOLERANCES BETWEEN CASTINGS AND STRUCTURAL FRAMING

A. The steel fabricator shall assume responsibility for the final coordination between cast steel product tolerances and the overall structural geometry, including allowances for fabrication and erection tolerances.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Cast Connex Corporation; 366 Adelaide Street East, Suite 425, Toronto ON. Tel: (416) 806-3521. Email: info@castconnex.com. Web: www.castconnex.com.

B. Substitutions: See Secti0n 012500 - SUBSTITUTION REQUEST PROCEDURES.

2.02 STRUCTURAL CAST STEEL COMPONENTS

A. Universal Pin Connectors (UPC): Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Materials shall comply with manufacturer's current published data for dimensions.
   2. Connectors shall be supplied with hot-dip galvanized carbon steel pins, carbon steel spacers, and electropolished stainless steel cap plates, countersunk retaining screws, and washers.

B. Architectural Tapers (ART): Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Materials shall comply with manufacturer's current published data for dimensions.

C. Architectural Tapers (ART) and Universal Pin Connectors (UPC), where used together: Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Universal Pin Connector and Architectural Taper shall be welded by the Steel Fabricator to form the connection assembly. Strengths are governed by the Universal Pin Connector.
   2. Materials shall comply with manufacturer's current published data for dimensions.
   3. Universal Pin Connectors shall be supplied with hot-dip galvanized carbon steel pins, carbon steel spacers, and electropolished stainless steel cap plates, countersunk retaining screws, and washers.
   4. Carbon steel spacers shall be tack welded to and coated with the gusset plate to which the connector is pin connected.

D. Diablo Bolted Splices (DBS): Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Materials shall comply with manufacturer's current published data for dimensions and connection strengths.
   2. Unless otherwise noted, the Steel Fabricator shall supply cover plates to conceal the bolted portion of the splice.

E. High Strength Connectors (HSC): Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Materials shall comply with manufacturer's current published data for dimensions.
   2. Meet requirements in ICC-ES ESR 3031 for Cast Connex High Strength Connectors.
   3. The welded joint between the connectors and the round HSS or pipe member shall be a complete joint penetration (CJP) weld and shall comply with the requirements set forth for demand critical welds in AISC 341, AISC 360 , AWS D1.1/D1.1M, and AWS D1.8 for welded connections in seismic-resistant applications.
   4. Where High Strength Connectors are bolted to gusset plates, bolts must be pre-tensioned.

F. Cast Bolted Brackets (CBB): Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Materials shall comply with manufacturer's current published data for dimensions and shall meet the requirements set out in AISC 358 Chapter 9 for Cast Bolted Bracket Moment Connection.

G. Custom Designed Castings: Provide as shown on the drawings, as manufactured by Cast Connex Corporation, including:
   1. Structural Requirements: a. The steel castings shall be engineered to resist the forces indicated on the structural drawings and shall have general out-and-out dimensions as shown on the structural drawings.
   2. Architectural Requirements:
      a. a. The exterior shaping of the steel castings shall generally conform to that shown on the drawings. All edges shall be radiused and the Manufacturer may draft flat surfaces away from parting lines.
      b. Castings shall be furnished with visual inspection of exterior surfaces to confirm compliance with ASTM A802, Level 1.

H. Timber End Connectors (TEC): Provide as shown on the drawings, as manufactured by Cast Connex Corporation including:
   1. Materials shall comply with manufacturer's current published data for dimensions.
   2. Connection between the Timber End Connector and the timber/glulam element shall be coordinated between Cast Connex Corporation and the Timber Supplier.

PART 3 EXECUTION

3.01 RELATED STEEL FABRICATION

A. Cast steel products are to be delivered to the shop of the steel fabricator and incorporated into the structural steelwork by the steel fabricator.

B. Base material joint preparation and cleaning:
   1. Prior to welding, steel casting surfaces for welding shall be prepared by the steel fabricator and shall be clean and free from paint, oil, rust, scale, slag, grease, and other foreign materials that are detrimental to welding.

C. Welds between the connectors and the attaching structural member shall be ground flush and smooth to the exterior of the connector or, if loading allows and the steel assembly incorporating the connectors will be within the building envelope, the welded joints may be prepared with a concave finish and an automotive body filler material that is compatible with the steel coating system may be used to mask the welded joint.

D. Unless otherwise noted on the drawings, cast steel products are to be coated along with and using the same coating system as applied to the attaching structural steel elements.
   1. Do not apply coatings to any stainless steel pin accessories supplied by Cast Connex Corporation.

E. Carbon steel spacers for Universal Pin Connectors shall be tack welded to and coated with the gusset plate to which the connector is pin connected.

F. Cover plates for Diablos Bolted Splices shall be coated using the same coating system as applied to the attaching structural steel elements. Unless otherwise noted, seams shall be calked or filled with an automotive body filler material that is compatible with the steel coating system and touched up with paint.

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. Joist Girders with bridging.
   3. Loose bearing plates and anchors for site placement.
   4. Framed openings greater than 18 inches.
   5. 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: K-series steel joists and KCS-type K-series steel joists. Size as indicated on the drawings.
   2. Joist Type: LH series steel joists. Size as indicated on the drawings.
   3. Joist Girders: Size as indicated on the drawings.
   4. 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

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. Non-composite form deck and accessories.
   3. Formed steel cant strips.
   4. Pourstop angles, cell closures and end forms to contain wet concrete.
   5. Bearing plates and angles
   6. Framing for openings up to and including 18 inches.
   7. 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 - ACOUSTICAL METAL CEILINGS.

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. Profile Depth: 1-1/2 inches (38 mm) or as indicated on the drawings.
4. Design Uncoated-Steel Thickness: 20 gauge unless otherwise indicated.
5. Span Condition: Three span.
6. Side Laps: Overlapped.

2.02 NON-COMPOSITE FORM DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Nucor Corp.; Vulcraft Group.
   2. Canam.
   3. New Millennium Building Systems.
   4. Architect/Engineer approved equivalent.

B. Non-composite Form Deck: Fabricate ribbed-steel sheet no composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 80 (550) minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard.
   2. Galvanized and Shop-Primed Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 80 (550), G60 (Z180) zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Gray.
   3. Profile Depth: 1-5/16 inch. or as indicated on the contract drawings..
   4. Design Uncoated-Steel Thickness: 20 gauge, 0.0239 inch (0.61 mm).
   5. Span Condition: Three span.
   6. Side Laps: Overlapped.

2.03 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: 3/4 inch diameter, 4 1/2" inch long welded headed studs. 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.

2.04 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 steel support members at ends and intermediate supports with fusion welds at 12 inches on center maximum, parallel with the deck flute and at each transverse flute. Weld washers are to be used only with decks 24 gauge or thinner.

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 fusion weld 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.

S. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:
   1. Weld Diameter: 3/4 inch (19 mm), nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 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 18 inches (457 mm), 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.
   3. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds where deck is thicker than 20 gauge.

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. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck flutes. Space welds not more than 6 inches apart with at least one weld at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and weld .

E. 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.

F. Place metal cant strips in position and fusion weld.

G. Install sheet steel closures and angle flashings to close openings between deck and walls, columns and openings.

3.04 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 3/4 inch (19 mm), nominal.
   2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart.
   3. Weld Spacing: Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 18 inches (914 mm), and as follows:
   1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
   2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds where deck is thicker than 20 gauge.

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.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated. Where steel angles are not utilized, install stops at floor edge upturned to the top surface of the slab to contain wet concrete. Provide stop of sufficient strength to remain in place and stationary without distortion.

E. Floor deck closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and deck.

F. Position floor drain pans with the flanges bearing on the top surface of deck. Fusion weld at each deck flute.

G. Install piercing hanger tabs at 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides unless otherwise indicated.

3.05 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.

3.06 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

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. 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 2020 Building Code of 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

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.

F. LEED Data Submissions: See Section 018113 - SUSTAINABILITY DESIGN REQUIREMENTS for required submittals.

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.
a. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
b. For Solid Hardwood treads: Provide 3/8 inch individual strips routed into treads spaced 1 1/2 inch apart. Color of abrasive shall be as selected by the architect.
c. Provide solid-abrasive-type units without ribs.
d. Nosings: Square-back units, 3 inches (75 mm) wide, without lip.
e. Nosings: Two-piece units, 3 inches (75 mm) wide, with subchannel for casting into concrete.

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 033000 - FIRE EXTINGUISHERS 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 - SHEET METAL FLASHING AND TRIM 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 033000 - FIRE EXTINGUISHERS
   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

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. The work of this Section includes, but is not limited to, the following:
   1. Extruded aluminum safety treads with integral nosings.
   2. Extruded aluminum safety nosings.
   3. Photoluminescent aluminum safety treads with integral nosings.
   4. Photoluminescent aluminum safety nosings.
   5. Renovation safety treads and nosings.

B. Related Sections: Other specification sections which directly relate to the work of this section include, but are not limited to, the following:
   1. Section 033000 – Cast-In-Place Concrete
   2. Section 033500 – Concrete Finishing
   3. Section 096513 – Resilient Base and Accessories for interior rubber stair treads with integral nosings.

1.03 STANDARDS AND REFERENCES (LATEST EDITION)

A. Americans with Disabilities Act (ADA).

B. ASTM International (ASTM):
   1. ASTM B30 – “Standard Specification for Copper Alloys in Ingot Form”.
   2. ASTM B221 – “Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes”.
   3. ASTM D635 – “Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position”.
   4. ASTM D3648 – “Standard Practices for the Measurement of Radioactivity”.
   5. ASTM D4828 – “Standard Test Methods for Practical Washability of Organic Coatings”.

C. International Standards Organization (ISO): ISO 17398 – Safety colors and safety signs – Classification, performance and durability of safety signs.

D. SMP 800C: Toxic gas sampling and analytical procedures.

E. Military Specification: Mil-D-17951E; Deck Covering, Lightweight, Nonslip, Abrasive Particle Coated Fabric, Film, or Composite and Sealing Compound.

F. California Code of Regulations (CCR): California Title 24; Code for the Visually Impaired.

G. New York City Building Code Reference Standards: RS 6-1- Photoluminescent exit path markings.

1.04 SUBMITTALS

A. Submit pursuant to Section 013300 – Submittal Procedures.

B. Submit pursuant to Section 016000 – Product Requirements.

C. Product Data: Manufacturer’s data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Cleaning and maintenance instructions.

D. Shop Drawings: Provide shop drawings indicating details of construction and installation.

E. Selection Samples: Submit two sets of samples showing available colors, patterns, textures, and finishes.

F. Verification Samples: For each product specified, two samples approximately 3 inches long, representing actual materials.

1.05 QUALITY ASSURANCE

A. Manufacturer: Obtain stair nosing assemblies through one source from an approved Manufacturer.
   1. Manufacturer shall be ISO 9001 Certified or shall be an Approved Manufacturer for an ISO Certified Supplier.
      a. ISO 9001:2000 Certified Manufacturer shall have documented management and control of the processes that influence the quality of its products.
      b. Approved Manufacturer shall be approved by the Approved Supplier and shall have documented specifications that control their processes and influence the quality of its customer service.
   2. Manufacturer shall have a minimum of ten (10) years of experience in the fabrication of stair nosing systems.

B. Installer: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the manufacturer of the system.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards. Protect from damage.

B. Store products in manufacturer's labeled packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Balco, Inc., PO Box 17249, 2626 S. Sheridan, Wichita, KS 67217; Phone 800-767-0082.

B. Wooster Products, Inc., 1000 Spruce St., PO Box 6005; Wooster, OH 44691; Phone 800-321-4936; Basis of Specification.

C. Architect Approved Equivalent.

2.02 EXTRUDED ALUMINUM SAFETY TREADS AND NOSINGS

A. Type: 231 BF Supergrit® 3" wide, ¼" thickness, safety nosings for exterior stair treads.

B. Nosing base shall be type 6063-T5 extruded aluminum.

C. Anti-slip filler shall contain not less than 65% virgin grain Aluminum Oxide (AL2O3) abrasive.

D. Nosings shall have passed Fire Resistance Test (Federal Test Method Std. No. 501a, Method 6411).

E. Nosings shall terminate not more than 4” from ends of steps for poured concrete stairs.

F. Color shall extend uniformly throughout the filler. Color as selected by Architect from manufacturer’s standard colors.

G. Provide protective tape. Protective tape should be removed as soon as possible once installed.

H. Nosings shall finish flush with the top of the traffic surface.

I. Anchoring Hardware: Provide manufacturer’s recommended anchoring hardware to achieve best results for substrate and application.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer’s recommended installation tolerances and conditions.

B. Do no proceed with installation until substrates have been properly prepared and deviations from manufacturer’s recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Commencement of installation constitutes acceptance of conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer’s written instructions and recommendations, including but not limited to the following.
   1. Schedule pours so as to install the metal safety nosings quickly before the initial set of the concrete occurs.
   2. Puddle the concrete and tamp safety nosing to insure proper concrete formation around the anchors.
   3. Remove protective tape upon completion of installation.
   4. Close area after pour; permit no use for 48 hours.

3.03 CLEANING AND PROTECTION

A. Cleaning: Clean treads and nosings as recommended by manufacturer. Remove scuff and heel marks prior to Substantial Completion.

B. Protection: Protect installed work from damage due to subsequent construction activity on the site including the application of sealer to the concrete stairs.

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 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Component Aluminum Railings
   2. Infill panel system for component aluminum railings

1.03 PERFORMANCE REQUIREMENTS

A. All railings shall be supplied to conform to applicable sections of the following codes:
   1. ICC A117.1-2009.
   2. ADA Standards.
   3. 2020 Buidling Code of New York State.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ft. applied in any direction.
      b. Concentrated load of 200 lbf. applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
      d. Top Rails of Guards:
         1) Uniform load of 50 lbf/ft. applied in any direction.
         2) Concentrated load of 200 lbf. applied in any direction.
         3) Uniform and concentrated loads need not be assumed to act concurrently.
      e. Infill Area of Guards:
         1) Horizontal concentrated load of 50 lbf. applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area. Load on infill area need not be assumed to act concurrently with loads on top rails.

C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120°F, ambient; 180°F, material surfaces.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

E. Qualification Data: For professional engineer.
   1. Product Test Reports: Supplier shall submit calculations and test reports for complete system, including railing and infill panels. Calculations and test reports shall be stamped by a licensed PE. Test reports shall be in accordance with ASTM E935.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Mock-up Panel: one section of railing system for verification.
   1. Approximate Size: ¼ to ½ of full size, using full size components.
   2. Approved mockups may become part of the completed work if undamaged at time of Substantial Completion.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents unless such deviations are specifically approved by Architect in writing.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Railing Product: Subject to compliance with requirements, provide ornamental perforated aluminum panel railing as manufactured and assembled by BOK Modern, Inc.; FOLD Railing System; www.bokmodern.com or an approved equivalent. Single source manufacturer is required.

2.02 METALS, GENERAL

A. Metal Surfaces: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations or blemishes; unless allowed for specific metal types and finishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.03 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B221, Alloy 6063-T5/T52, 6005-T5
   1. Provide 1 ½ in IPS, (1.90 in OD) Standard Weight (Schedule 40) pipe for rails, Schedule 80 for posts, Schedule 10 for pickets, unless otherwise indicated

C. Extruded Structural Pipe and Round Tubing: ASTM B429/B429M, Alloy 6061-T6.
   1. Provide 1 ½ in IPS, (1.90 in OD) Standard Weight (Schedule 40) pipe for rails, Schedule 80 for posts, unless otherwise indicated

D. Drawn Seamless Tubing: ASTM B210, Alloy 6063-T832

E. Plate and Sheet: ASTM B209, Alloy 6061-T6

F. Perforated Aluminum Sheet: AA5052-H32, 0.1875-inch (4.76 mm) thick.
   1. Panel Pattern: As selected by the Architect from the manufacturer's full pattern library.

G. Die and Hand Forgings: ASTM B247, Alloy 6061-T6
   1. Base Flange Castings: ASTM B26/B26M, Alloy Almag 535

H. Panel Clips and Structural Fasteners: Alloy 6063-T6

2.04 STEEL

A. Perforated Stainless Steel Sheet: ASTM A240/A240M, Type 304, 0.062- inch(1.57 mm) thick.

B. Panel Pattern: As selected by the Architect from the manufacturer's full pattern library.

2.05 FASTENERS

A. General: Provide the following:
   1. Aluminum Railings: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
   1. Structural Fasteners for Interconnecting Railing Components:
      a. Rails shall be attached to posts by means of tee fittings equipped with anodized aluminum, tubular rivet nut and stainless steel socket head cap screw. All structural fasteners such as tee fittings shall be machined from 6063-T6 aluminum alloy. The fitting shall be internally connected to the rail by means of an internal dual tang that is expanded with a stainless steel, internal /external, reverse knurl, cup point socket head set screw. This combination shall prevent any loosening of the system due to changes in temperature or vibration. Systems using pop rivets or adhesives will not be accepted.
   2. Fasten infill panels to rails and posts with Hollaender model 145 panel clips, machined from 6063-T6 aluminum alloy. Secure the infill panels in the panel clips with reverse-knurl cup-point set screws. Fasten panel clips to rails and posts with ¼ - 20 sheet metal screws.

C. Anchors: Provide concrete adhesive anchors where indicated or necessary.

2.06 INFILL FOR RAILINGS

A. Panels Material, Type, Patterns and finishes as specified herein and as indicated on the drawings.

2.07 HANDRAIL FOR ADA RAMPS OR STAIRWAYS (AS REQUIRED)

A. Ramps that have a drop off of 30 inches or more on the side require guardrail, per above spec. Ramps with a rise greater than 6 inches shall have handrails on both sides.

B. Stairways shall have handrails on both sides.

C. Handrail will be attached to the guardrail sections using Hollaender model 85 adjustable brackets.

D. Handrail will be installed at a height of 34 – 38 inches above ramp surface or stair tread nosings.

E. Handrail will be anodized aluminum 6063 Sch 40, 1 ½ in IPS nominal (1.90 in. OD) and shall have a continuous surface. Where necessary, lengths of the handrail will be spliced using Hollaender Model 70ES-8 internal locking splices.

F. Handrails shall return to a wall, guard or walking surface. If returning to the guard, Hollaender model 185 post return swivel shall be used to connect the end of the handrail to the guardrail post.

2.08 MISCELLANEOUS MATERIALS

A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.09 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with non-welded connections, unless otherwise indicated. Welding will not be accepted.

H. Non-welded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fittings to be of the internal double tang type activated by a reverse knurl cup point set screw. Reverse knurl is required to ensure that screw does not come loose under vibration. Plain cup point screws will not be accepted. Fittings to be fastened to pipe by means of a 5/16 in. tubular rivet nut and socket head cap screw.

I. Form changes in direction as follows:
   1. By flush bends or by inserting prefabricated flush-elbow fittings.

J. 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.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated. Flanges to be sand cast from aluminum alloy 535 with anodized finish and fastened directly to the post by means of two reverse knurl cup point set screws.

N. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. Provide railing toe plates when adjacent to or above and open to stair system, floor or grade below and in accordance with the following:
   1. Size; 4-inch high extruded section.
   2. Clearance of Toe Plate Bottom Above Top of Walking Surface: 1/8 inch minimum and 1/4 inch maximum. Notch flanges as required at railing posts and post base plates.
   3. Attach to each rail post with clamps which will allow for temperature expansion and contraction between posts.
   4. Provide expansion joints in toeboard at railing expansion joints.
   5. Provide pre-manufactured corners for field installation.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.11 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Unless indicated otherwise, provide aluminum with the following finish:
   1. Anodized Finish: AA-M10C22A41 (Architectural class, .7 mil thickness or greater)
   2. Powder Coat Finish: Kynar 70% PVDF Fluoropolymer, AAMA 2605, in color selected by the Architect.

2.12 STEEL FINISHES

A. Powder Coating:
   1. Pretreat according to AAMA 2605 to withstand a minimum of 2000 hours (ASTM B117) or 1500 hours (ASTM G85 Annex A2).
   2. Apply zinc rich primer for steel at minimum of 2.0 mils 50 percent or less cure to ensure proper inter coat adhesion to topcoat.
   3. Apply AAMA 2605 compliant topcoat at a minimum of 2.0 mils and process according to manufacturer's written recommendations.
   4. Color and Gloss: As selected by Architect from manufacturers standard range.

B. Cor-ten or weathering steel unfinished mill material with no significant scratches or gouges.

2.13 STAINLESS STEEL FINISHES

A. Polished Finishes:
   1. Grind and polish surfaces to produce uniform finish free of cross scratches.

B. Mill finish with no additional treatment to surfaces.

C. Orbital sanding.

D. Pre-grained #4 finish on available gauge material.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to commencement of work, verify that substrate and site conditions are acceptable and ready to receive work.

B. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Comply with Drawings and manufacturer's written instructions.

B. Fit exposed connections together to form tight, hairline joints.

C. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

D. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint, or provide protective gaskets.

E. Adjust railings before anchoring to ensure matching alignment at abutting joints.

F. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

G. Use manufacturer's hardware for panel-to-panel connections.

H. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

I. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.03 RAILING CONNECTIONS

A. Non-welded Connections: Use mechanical joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.04 ANCHORING RAILING ENDS

A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using non-welded connections.

3.05 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as indicated, or if not indicated, 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. Provide blocking between studs in stud wall construction.

3.06 ADJUSTING AND CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touch-up and repair damage to exposed finishes to be indistinguishable from undamaged areas.
   1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.
   2. Obtain approved coating for repainting surfaces from manufacturer.

C. Return and replace items that cannot be repaired or refinished in field.

3.07 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tempered Monolithic Glass Dry Glazed Railing Assemblies.

1.02 REFERENCES

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

E. ESR-3269 ICC-ES Evaluation Report, International Code Council Standards for Glass Balustrade Guard Rail Applications

F. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements for the Railing Assemblies:
   1. Support distributed load of 50 pounds per linear foot (0.73kN/M), applied horizontally at right angles in any direction to the handrail.
   2. Support concentrated horizontal load of 200 pounds (0.89kN), applied in any direction at any point along handrail system.
   3. 50 lbs (0.22kN) on 1 sf (0.093m2) perpendicular to guard at any location
   4. Wind loads 25 psf or as otherwise specified.
   5. Distributed loads and concentrated loads not to be applied simultaneously.

1.04 SUBMITTALS

A. Submit under provisions of Section 013300 - SHEET METAL WORK.

B. Product Data: Submit Manufacturer’s technical product data for railing components and accessories.

C. Shop Drawings: Dimensioned drawings of railing assemblies indicating the following:
   1. Provide engineering calculations performed, signed and sealed to show conformance of the railing system design with the required loading noted in this Section under "Performance Requirements". Calculations and associated details and drawings shall be signed and sealed by Professional Engineer licensed in the State in which the project is located.
   2. Elevations; include joint locations, transitions, and terminations.
      a. Manufacturer’s installation and maintenance instructions.

D. Samples of manufacturer’s finishes as selected by the Architect from the manufacture's full range of finishes and colors.

1.05 QUALITY ASSURANCE

A. Components and installation are to be in accordance with state and local building codes.

B. All components and fittings are furnished by the same manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials properly protected against damage to finished surfaces during transit.

B. Inspect materials upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.

C. Store materials at building site under cover in dry location

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: C.R. Laurence Co., Inc. (CRL)
Tel: (800) 421-6144 Fax: (800) 587-7501
Email: railings@crlaurence.com
www.crlaurence.com

B. Manufacturers of equivalent products will be considered for substitution in accordance with provisions of Section 012500 - Product Substitution Requirements.

2.02 MATERIALS

A. Aluminum Components: Conforming to ASTM B221, Alloy 6063- T52

B. Stainless Steel Components: Conforming to ASTM A666, Type 304

2.03 COMPONENTS

A. Glazing: Fully tempered ASTM C1048 Kind FT, Quality q3.
1. Monolithic Low Iron Starphire Tempered Glazing Thickness: 3/4 inch.
2. Color: Clear.
3. Glass Edge: Ground and polished.

B. Internal Handrail Cap Connection Sleeves: Metal tube, material compatible with handrail cap material.

C. TAPER-LOC® Dry Glazing System for Laminated Tempered Glass: Each TAPER-LOC® Set consists of four Tapers, and one L-Setting Block. Designed for B7S (3/4 inch) Shoe Bases. Patent Pending.

D. Shoe Base:
1. Profile: CRL Part # B7S; 2-3/4 inches (69.8 mm) wide by 4-1/8 inches (104.7 mm) high rectangular cross-section. Designed to work with CRL's TAPER-LOC® Dry Glazed System with 3/4" (19 mm) monolithic tempered glass.
2. Material: Aluminum 6063-T52
3. Finish:

a. Base Cladding: Sheet metal cladding added to exposed shoe base sections. Adhere with double-sided tape and/or silicone adhesive. Provide end caps where ends of shoe base sections are exposed.
   1) 304 Brushed Stainless

E. Metal Cap Railing:
   1. Profile: Part # GRLC107, crisp corner low profile 11 gauge u-channel 1-5/16 inches (33.3 mm) high.
   2. Material: Brushed Stainless (316).
   3. Thickness: 0.125 inch
   4. Provide matching preformed corners, End Caps, Vertical Corners, rubber cap rail inserts and internal sleeve connectors, cements and adhesives for a complete system installation.

F. Handrail Brackets:
   1. Material: Stainless Steel
      a. Item: HR2F GBS Series (double sided).
   2. Fabrication: Machined
   3. Finish: Match handrail cap finish

G. Wood Handrail:
   1. Profile: Part # WD15, round 1-1/2 inches (38.1 mm) diameter
   2. Wood Type: Walnut.

H. Fasteners: Types and sizes indicated in shop drawings.
   1. For concrete attachment, hole size in base shoe is to be 9/16” (14.3 mm), counter bore 7/8” (22.2 mm) x depth ½” (12.7 mm), center-to-center spacing of holes is 12" (305 mm). Use Hilti HSL3 M12 Expansion Anchors 3-3/4" (95 mm) long CRL Part # EBA334, Washer is included.

2.04 FABRICATION

A. Fabricate handrail assembly components to lengths and configurations complying with shop drawings.

B. Machine joint edges smooth and plane to produce hairline seams when site assembled; supply concealed sleeve connectors for joints.

C. Isolate dissimilar metals to prevent electrolytic action by applying primer to concealed surfaces of metal components.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install handrails in accordance with manufacturer’s recommended installation instructions and approved shop drawings.

3.02 CLEANING

A. Clean glazing surfaces after installation, complying with requirements contained in the manufacturer’s instructions. Remove excess glazing sealant compounds, dirt or other substances.

B. Remove protective films from metal surfaces.

C. Clean railing surfaces with clean water and mild detergent. Do not use abrasive chemicals, detergents, or other implements that may mar or gouge the material.

3.03 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that all the materials do not incur any damage or deterioration.

B. Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations; replace damaged components that cannot be repaired to Architect's acceptance.

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. Treated Wood Members.
   2. Fasteners.
   3. Wood blocking, cants, and nailers.
   4. Wood furring and grounds.

1.03 REFERENCES:

A. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

B. AWPA - (American Wood Preservers Association) C1 - All Timber Products Preservative Treatment by Pressure Process.

C. APA - American Plywood Association.

D. AITC - American Institute of Timber Construction.

E. US Department of Commerce (DOC):
   1. DOC PS 1 - Performance Standard for Structural Plywood.
   2. DOC PS 2 - Performance Standard for Wood-Based Structural Panels.

F. International Code Council (ICC):
   1. ICC IBC - International Building Code

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 D 5664.
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. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion 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 D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841.

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 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.

2.05 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.

2.06 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.

2.07 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

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Roof sheathing.
   3. Sheathing joint and penetration treatment.

1.02 REFERENCES

A. American Society of Mechanical Engineers (ASME):
   1. ASME B18.6.1 - Wood Screws (Inch Series).

B. ASTM International (ASTM):
   1. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials
   3. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings
   4. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
   5. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

C. US Department of Commerce (DOC):
   1. DOC PS 2 - Performance Standard for Wood-Based Structural Panels.

D. International Code Council (ICC):
   1. ICC IBC - International Building Code.

E. ICC Evaluation Service, Inc. (ICC-ES):
   1. AC38 - Acceptance Criteria for Weather Resistive Barriers
   2. ICC-ES AC116 - Acceptance Criteria for Nails and Spikes
   3. ICC-ES AC148 - Acceptance Criteria For Flexible Flashing Materials

F. International Association of Plumbing and Mechanical Officials (IAPMO):

1.03 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.

1.04 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:
   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.
   3. Plywood Sheathing.
   4. Foam-plastic sheathing.
   5. Seam Tape.

B. Product Certifications: From manufacturer, indicating that sheathing products comply with ICC ES AC266 and ICC-ES AC310.

1.05 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle, Transport and Store Plywood Panels in accordance with the APA Storage and Handling recommendations.

B. Stack panels flat with a minimum of three, full panel width, 4 inch by 4 inch spacers per eight foot panel length beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory".

2.02 WOOD PANEL PRODUCTS

A. Plywood: DOC PS 1 - Voluntary Product Standard for Construction and Industrial Structural Plywood.

B. Oriented Strand Board: DOC PS 2, made with binder containing no added urea formaldehyde.

C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.03 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3b for exterior construction not in contact with the ground and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.04 FIRE-RETARDANT-TREATED PLYWOOD

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 Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. 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 plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings, and the following:
   1. Roof and wall sheathing within 48 inches (1220 mm) of fire walls.
   2. Roof sheathing.
   3. Subflooring and underlayment for raised platforms.

2.05 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
   1. Span Rating: Not less than 24/0.
   2. Nominal Thickness: Not less than 5/8 inch.

B. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
   1. Products: Subject to compliance with requirements, provide the following:
      a. CertainTeed Corporation; GlasRoc.
      b. G-P Gypsum Corporation; Dens-Glass Gold.
      c. National Gypsum Company; Gold Bond e(2)XP.
      d. United States Gypsum Co.; Securock.
   2. Type and Thickness: Type X, 5/8 inch thick.
   3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

C. Cementitious Backer Units: ASTM C1325, Type A.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. USG Corporation; DUROCK Cement Board.
b. Or approved equal.
2. Thickness: 1/2 inch.

D. Extruded-Polystyrene-Foam Wall Sheathing: ASTM C578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
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. DuPont de Nemours, Inc.
b. Kingspan Insulation LLC (GreenGuard)
2. Thickness: As indicated.

2.06 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
1. Span Rating: Not less than 24/0.
2. Nominal Thickness: Not less than 3/4 inch (19 mm).

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. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153 or Type 304 stainless steel..

B. Nails, Brads, and Staples: ASTM F1667, ICC AC116 and ICC AC201.

C. Power-Driven Fasteners: ICC-ES-1539 or NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C1002, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
1. Manufacturer: Grabber Construction Products - PLYLOK Flat Head or Architect approved equivalent.
2. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM F1428.
1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C954.

2.08 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other

materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 - JOINT SEALANTS.

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C920, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
   1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.09 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

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. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by 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".

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and 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.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Wall and Roof Sheathing:
      a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch (3 mm) apart at edges and ends.

C. Air and Moisture Barrier: Coordinate sheathing installation with flashing and joint sealant sequencing and installation and with adjacent building air and moisture barrier components to provide complete, continuous air- and moisture- barrier.

D. Do not bridge expansion joints; allow joint spacing equal to spacing of structural supports.

E. Install panels with laminated facer to exterior. Stagger end joints of adjacent panel runs. Support all panel edges.
   1. Space square-edged panels 0.125 inch (3 mm).
   2. Butt edges of self-spacing edge panels.

F. Roof Sheathing Panel Clips: Where required under code approvals based upon panel thickness and support spacing, provide panel clips located at each unsupported panel butt joint centered between supports.

G. Apply ZIP System Tape at all panel seams, penetrations, and facer defects or cracks to form continuous weathertight surface. Apply tape according to manufacturer's written instructions and requirements of ICC-ES applicable to tape application.

3.03 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to wood framing with screws.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   3. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
   4. Install boards with a 1/4-inch (6.4-mm) 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, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. 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 steel stud.
   1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards unless a tighter spacing is required by Structural Drawings
   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 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of boards unless a tighter spacing is required by Structural Drawings.
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. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.04 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.05 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood casings and moldings.

C. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 081416 - Flush Wood Doors.

C. Section 099123 - Interior Painting: Painting of finish carpentry items.

D. Section 099300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ANSI A208.1 - American National Standard for Particleboard; 2022.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

D. ASTM C1036 - Standard Specification for Flat Glass; 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

G. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

H. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

I. AWPA U1 - Use Category System: User Specification for Treated Wood; 2022.

J. BHMA A156.9 - Cabinet Hardware; 2020.

K. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2020.

L. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

M. PS 1 - Structural Plywood; 2009 (Revised 2019).

N. PS 20 - American Softwood Lumber Standard; 2021.

O. WI (CCP) - Certified Compliance Program (CCP); Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, installation of associated and adjacent components, and provision of plumbing fixture templates.

1.05 SUBMITTALS

A. See Section 013300 - SHEET METAL WORK for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware, finish hardware, and support hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   3. Include certification program label.

D. Samples: Submit two samples of finish plywood, 6 x 6 inch (152 x152 mm) in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of wood trim 6 inch (152 mm) long.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. LEED Data Submissions: See Section 018113 - SUSTAINABILITY DESIGN REQUIREMENTS for required submittals.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:
   1. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   2. Provide designated labels on shop drawings as required by certification program.
   3. Provide designated labels on installed products as required by certification program.
   4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, Crown and Miscellaneous Trim: White Oak; prepare for Stain finish.
   2. Door, Glazed Light, and Pocket Door Frames: White Oak; prepare for paint finish.
   3. Window Sills: White Oak; prepare for Stain finish.
   4. Loose Shelving: White Oak plywood; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Wood fabricated from timber recovered from riverbeds or otherwise abandoned is permitted, unless indicated otherwise, and provided it is clean and free of contamination, identify source; provide lumber re-graded by an inspection service accredited by the American Lumber Standard Committee, Inc. (ALSC).

2.03 LUMBER MATERIALS

A. Softwood Lumber: Poplar species, Planed, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
   1. Grading: In accordance with rules certified by ALSC; www.alsc.org.

B. Hardwood Lumber: White Oak species, Abrasive Planed, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.04 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.05 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Plastic Laminate: NEMA LD 3, HGS; color as selected by Architect; textured, low gloss finish; color and pattern as selected by the Architect manufactured by Formica or approved equal.

B. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.06 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Concealed Joint Fasteners: Threaded steel.

2.07 ACCESSORIES

A. Lumber for Shimming and Blocking: Softwood lumber of Cedar or Pine species.

B. Primer: As specified in Section 099123.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.08 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware" and as indicated on the drawings.

B. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

C. Shelf Rests: BHMA A156.9, B04013; metal.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.09 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Standard Shelf, Countertop, and Workstation Brackets:
   1. Material: Aluminum.
   2. Finish: Brushed; with clear, factory-applied coating.
   3. Products:
      a. A&M Hardware, Inc ; Standard Brackets: http://www.aandmhardware.com/#sle.

C. Americans with Disabilities Act (ADA)-Compliant Vanity and Countertop Brackets:
   1. Material: Stainless steel.
   2. Finish: Brushed.
   3. Products:
      a. A&M Hardware, Inc ; ADA Vanity Brackets: http://www.aandmhardware.com/#sle.

D. Specialty Shelf Brackets:
   1. Material: Steel.
   2. Manufacturer's standard, factory-applied, textured powder coat.
   3. Color: Black.
   4. Products:
      a. A&M Hardware, Inc; Concealed Flat Brackets: http://www.aandmhardware.com/#sle.

2.10 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

C. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

D. Redry wood after pressure treatment to maximum 15 percent moisture content.

2.11 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

C. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

2.12 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 12, Polyurethane, Water-based.
      b. Stain: As selected by Architect/Engineer.
      c. Sheen: Flat.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

C. See Section 061000 - Rough Carpentry for installation of recessed wood blocking.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

D. Install hardware in accordance with manufacturer's written instructions.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coat(s) of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 099123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

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. This Section includes the following:
   1. Wood sills and trim
   2. Closet and utility shelving.

1.03 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Data: For high-pressure decorative laminates and Solid-surfacing materials.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

D. Samples for Initial Selection:
   1. Hardwood Sill and apron materials.

E. Samples for Verification:
   1. Hardwood material, 3 by 3 inches, for each species, cut, and surface finish.

F. Product Certificates: For each type of product, signed by product manufacturer.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation

areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide materials that comply with requirements of quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard, Particle Board, Hardboard, Softwood Plywood, Veneer Faced Panel Products: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
   3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
   4. Softwood Plywood: DOC PS 1, Medium Density Overlay.
   5. Solid Wood: Provide materials that comply with requirements of referenced quality standard for each type of wood and quality grade specified unless otherwise indicated.
      a. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
      b. Wood Moisture Content for Interior Materials: 5 to 10 percent.

2.02 MISCELLANEOUS MATERIALS

A. Furring, Blocking, and Shims: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.03 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.04 WOOD SILLS AND TRIM

A. Grade: Custom.

B. Wood Species and Cut:
   1. Species: Red Oak.
   2. Cut: Plain Sliced.
   3. Edge profile: Bullnose.
   4. Sill Extensions: As indicated on the drawings.
   5. Finish: Transsparent Stain in color selected by the Architect with two coats of polyuretnane in sheen selected by Architect.
   6. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. For sills and trim items other than aprons wider than available lumber, use veneered construction. Do not glue for width.

2.05 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 3/4-inch (19-mm) veneer-faced panel product with solid-lumber edge.

C. Cleats: 3/4-inch (19-mm) solid lumber.

D. Wood Species: Any closed-grain hardwood.

2.06 SHOP FINISHING

A. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of sills and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.02 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. 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. Section Includes:
   1. Architectural custom wood cabinets, desks, and custom casework.
   2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
   3. Shop finishing of architectural wood cabinets, desks, and custom casework.

B. Related Requirements:
   1. Section 061000 - Rough Carpentry for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
   2. Section 123200 - Manufactured Wood Casework
   3. Section 123661 - Quartz Surfacing Countertops and Windowsills.

1.03 PREINSTALLATION MEETINGS

A. Before starting installation of architectural cabinetry and casework, General Contractor shall hold a job-site meeting to discuss and coordinate the proper installation of materials.
   1. Require attendance with all parties directly related to cabinetry, casework, and countertop/work surface installation.
   2. Notify Architect, Owner's Representative, Casework Installer, Countertop Installer, Plumbing Contractor, Electrical Contractor and other contractors as necessary well in advance of meeting. Meeting shall occur immediately following a regularly scheduled project, progress meeting.
      a. If ANSUL System is to be located in wall cabinetry, include appropriate parties.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing penetrations, electrical switches, outlets, and other items installed in cabinets and casework.
      a. The kitchen range hood fire suppression system (ANSUL System) is to be located in an adjacent wall cabinet. Coordinate with ANSUL System contractor for placement of the system within the wall cabinet.
   4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the fitch and sequence within the fitch for each leaf.
   5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection:

1. Submit three (3) samples of each available shop-applied transparent finish available for selection by the Architect. If a specific color has been specified in the Contract Documents, this submission may be eliminated.

D. Samples for Verification:
   1. Lumber for transparent finish, not less than 5 inches (125 mm) wide by 12 inches (300 mm) long, for each species and cut, finished on one side and one edge.
   2. Veneer leaves representative of and selected from flitches to be used for transparent-finished cabinets.
   3. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
      b. Miter joints for standing trim.
   4. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Woodwork Quality Standard Compliance Certificates: WI Certified Compliance Program certificates.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: A Certified Participant in AWI's Certified Compliance Program.

C. 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.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.09 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

B. Hardware Coordination: Hardware is to match Wood Mode Standard Aluminum Finish Hardware; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 PRODUCTS

2.01 ARCHITECTURAL CABINET FABRICATORS

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural wood cabinets and casework with sequence-matched wood veneers and wood trim.

2.02 ARCHITECTURAL WOOD CABINETS, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural wood cabinets indicated for construction, finishes, installation, and other requirements.
   1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.03 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. Type of Construction: Frameless.

C. Cabinet and Door and Drawer Front Interface Style: Flush overlay.

D. Reveal Dimension: As indicated.

E. Wood for Exposed Surfaces:
   1. Species: Maple
   2. Cut: Plain sliced/plain sawn.
   3. Grain Direction: Vertically for doors and fixed panels, and drawer fronts.
   4. Matching of Veneer Leaves: Book match.
   5. Veneer Matching within Panel Face: Center-balance match.

6. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single fitch with doors, drawer fronts and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

F. Semi exposed Surfaces: Provide surface materials indicated below:
   1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
   2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber, same species indicated for exposed surfaces.
   3. Drawer Bottoms: Hardwood plywood.

G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued dovetail joints.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under countertops or work surfaces.

2.04 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
   2. Wood Moisture Content: 4 to 9 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
   2. Softwood Plywood: DOC PS 1, medium-density overlay.
   3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.

2.05 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 110 degrees of opening, self-closing and soft close.

B. Wire Pulls:
   1. Back mounted, solid metal, 5 inches (127 mm) long, 2-1/2 inches (63.5 mm) deep, and 5/16 inch (8 mm) in diameter.
      a. Finish: Satin chrome.
   2. Back mounted, solid metal, 6-5/16 inches center to center, 1-3/32-inch projection: Richelieu Contemporary Pull 8160.
      a. Finish: As selected by Architect from manufacturer's standard finishes.

C. Catches: Magnetic catches, BHMA A156.9, B03141.

D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

E. Shelf Rests: BHMA A156.9, B04013; metal.

F. Drawer Slides: BHMA A156.9.
   1. Grade 1HD-100: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   2. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.

G. Door and Drawer Locks: Furnish cam type locks on all doors and drawers indicated to have locks on Contract Drawings. Pantry cabinet doors to be keyed differently. Furnish two (2) keys per lock and four (4) master keys.
   1. Basis of Design: CompX National: Cam Lock.
   2. Type: Pin tumbler cylinder cam lock, brass construction, with chrome finish complying with BHMA A156.11.

H. Door and Drawer Silencers: BHMA A156.16, L03011.
   1. Provide on all cabinet/casework doors and drawers.

2.06 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives - General: Do not use adhesives that contain urea formaldehyde.

D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D, (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Multipurpose Construction Adhesives: 70 g/L.
   3. Contact Adhesives: 250 g/L.

E. Wood Putty: Pigmented, oil-based putty formulated specifically for use on wood.
   1. Color: Blend different colors colors of putty as required to match cabinet wood color(s).

2.07 FABRICATION

A. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets: 1/16 inch (1.5 mm) unless otherwise indicated.

B. Provide filler panels where required for the proper operation of cabinet doors (minimum 90 degree opening) near adjacent walls.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in

diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.08 SHOP FINISHING

A. General: Finish architectural wood cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Finish Materials: Use finish materials that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood cabinets, as applicable to each unit of work.

D. Transparent Finish:
   1. Grade: Premium.
   2. Finish System - 5, conversion varnish.
   3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
   4. Staining: Custom to match Architect's sample.
   5. Sheen: Satin, 31 - 45 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 EXECUTION

3.01 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.02 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
   1. For shop finished items use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish or toggle bolts through metal backing or metal framing behind wall finish.

G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
   1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

H. Refer to for final finishing of installed architectural woodwork.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

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. Plastic-laminate-faced architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
   4. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection:
   1. Plastic laminates.
   2. Wood edge banding profiles.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer fabricator.

B. Product Certificates: For each type of product.
   1. Composite wood and agrifiber products.
   2. Thermoset decorative panels.
   3. High-pressure decorative laminate (HPL).
   4. Adhesives.

C. Woodwork Quality Standard Compliance Certificates: AWI (AWS) Quality Certification Program certificates.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI (AWS)'s Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

C. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide labels from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom

C. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basis of Design: WB Manufacturing LLC (CaseworkUSA), 507 E Grant Street, Thorp, WI 54771. 800.242.2303
   2. Atlantic Millwork, 370 Sackett Point Road, North Haven, CT, 06473 - (203) 248-1969.

3. Tobin Woodworking, Inc., 155-B Allen Boulevard, Farmingdale, N.Y. 11735 (631) 249-1614.
4. M & D Millwork, LLC, 178 New Highway, Amityville, N.Y. 11701 (631) 608.4444 www.mdmillwork.com.
5. Lifetime Design Group, 162 E. Industry Court, Deer Park, N.Y. 11729 (631) 242.1162 www.lifetimedesigncorp.com.
6. Handcraft Cabinetry Inc., 230 Ferris Avenue, White Plains, N.Y. 10603 (914) 681-9437 mike@handcraftcabinetry.com.

D. Regional Materials: Plastic-laminate cabinets shall be manufactured within 500 miles (800 km) of Project site.

E. Type of Construction: Flush Overlay

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard. Drawing Schedule Item: (DPP-1)
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Wilsonart International; Div. of Premark International, Inc.
b. Formica Corporation
c. Or approved equal.

G. Laminate Cladding for Exposed Surfaces:
1. Horizontal Surfaces: Grade HGL.
2. Vertical Surfaces: Grade HGS.
3. Edges: Grade HGS.
4. Pattern Direction: As indicated.

H. Materials for Semi-exposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
1. As selected by Architect from laminate manufacturer's full range in the following categories:
a. Wood grains, matte finish.
b. Patterns, matte finish.

2.02 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Softwood Plywood: DOC PS 1.

2.03 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware" and as indicated on the drawings.

B. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

C. Shelf Rests: BHMA A156.9, B04013; metal.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.04 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.05 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.02 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi-exposed surfaces.

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 standing and running trim.
   2. Closet and utility shelving.
   3. Wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.03 ACTION SUBMITTALS

A. Samples for Initial Selection:

B. Samples for Verification:
   1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For the following:
   1. Adhesives.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. 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.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.07 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining

temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.08 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

PART 2 - PRODUCTS

2.01 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.
   1. Provide certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.02 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Grade: Custom.

B. Wood Species and Cut:
   1. Species: White Oak.
   2. Cut: Plain Sliced.
   3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

C. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
   1. For veneered base, use hardwood lumber core, glued for width.

D. For base wider than available lumber, glue for width. Do not use veneered construction.

E. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

2.03 CLOSET AND UTILITY SHELVING

A. Grade: Custom.

B. Shelf Material: 3/4-inch (19-mm) veneer-faced panel product with solid-lumber edge.

C. Cleats: 3/4-inch (19-mm) solid lumber.

D. Wood Species: Match species indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.

E. Closet Rods: Stanley, BB 8182 Series or approved equal, finish as selected by the Architect.

F. Closet Rod Flange set: Stanley V8600-Heavy Duty or approved equal, finish as selected by the Architect.

2.04 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
   1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches (75 mm) wide.
   2. Wood Moisture Content for Interior Materials: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
   1. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.05 MISCELLANEOUS MATERIALS

A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

2.06 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Edges of Solid-Wood (Lumber) Members: 1/16 inch (1.5 mm) unless otherwise indicated.
   2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

C. Back-kerf or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

D. Assemble casings in shop except where shipping limitations require field assembly.

E. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and back priming.

3.02 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
   1. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
   1. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
   2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).
   3. Install wall railings on indicated metal brackets securely fastened to wall framing.

G. Refer to Section 099123 - Interior Painting for final finishing of installed wood trim.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

B. Clean wood trim on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

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

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. Extruded Polystyrene foam board insulation.
   2. Mineral-wool blanket insulation.
   3. 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 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 de Nemours, Inc.buildingsolutions.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. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

C. Tape joints in rigid insulation with Henry Blueskin SA or equivalent material as recommended by the approved insulation manufacturer.

2.02 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 Cavity Insulation: CAVITYROCK; ASTM C612 Type IVB, Class A (faced surface with a flame-spread index of 25 or less per ASTM E84);
   1. Size: 16 inches or 24 inches wide as indicated on the drawings x 48 inch lengths.
   2. Thickness: 2, 4, 5, and 6 inches as required by the drawings.
   3. Density:
      a. Outer layer: 6.24 pcf, ASTM C612.
      b. Inner layer: 4.1 pcf, ASTM C612.
   4. R value: 4.2 per inch (1 and 2 inch thick products) and 4.3 per inch for 2.5 to 6 inch thicknesses.
   5. Note: Provide CAVITYROCK BLACK where indicated on the drawings and at all Rainscreen applications.

2.03 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84. Install where noted on the drawings.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Corporation.
      b. Gaco Western Inc.
      c. SWD Urethane Company.
   2. Minimum density of 1.5 lb/cu. ft., thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.04 THERMAL BARRIER

A. Intumescent Coating for SPF Insulation: DC315 Low VOC intumescent coating providing a 20 minute thermal barrier over SPF insulation in accordance with NFPA 286 and UL1715; AC456 compliant to meet IBC and IRC requirements; ASTM E84 - Flame spread 0 Smoke Developed 10.; ASTM E2768 - 30 minute ignition resistant material. Material shall cure by coalescence and be Spray applied at 24 mils (WFT), 67 % solids, Flat finish. Color: White.
   1. Manufacturer: International Fireproof Technology Inc. Tel.: (949)975-8588 or approved equal

2.05 VAPOR RETARDERS

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.

2.06 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 and 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

B. Final Cleaning: Upon completion, remove surplus materials, rubbish, tools and equipment in accordance with Section 017423 - APPLIED FIRE PROTECTION.

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

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 self-adhering, vapor-retarding, modified bituminous sheet air barriers.

1.03 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
   2. Ensure all contractors responsible for creating a continuous plane of air tightness are present.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.

B. Submit documentation from an approved independent testing laboratory certifying compliance with the following:
   1. Air leakage rates of the air barrier membrane assembly, including primary membrane, primer and sealants have been tested to meet ASTM E783.
   2. Standard ICC-AC 38.
   3. Peel adhesion to unprimed plywood and cyclic and elongation per ICC-AC 48, d) Class A flame spread index and smoke development per ASTM D4541.

C. Submit documentation from an approved independent testing laboratory certifying the air leakage and vapor permeance rates of the air barrier membrane, including primary membrane and transition sheets, exceed the requirements of the Energy Code and in accordance with ASTM E783.
   1. Test report submittals shall include test results of sustained wind loads and gust load air leakage results.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors, employed by the Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with air barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
   1. Build integrated mockups of exterior wall assembly , 150 sq. ft. (14 sq. m), incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
      a. Coordinate construction of mockups to permit inspection by Owner's testing agency of air barrier before external insulation and cladding are installed.
      b. Include junction with roofing membrane, building corner condition, and foundation wall intersection.
      c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   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.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
   1. Quantitative Air-Leakage Testing: Mockups will be tested for air leakage according to ASTM E 783.
   2. Adhesion Testing: Mockups will be tested for minimum air-barrier adhesion of 16 lbf/sq. in. (110 kPa) according to ASTM D 4541.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Refer to current Product MSDS for proper storage and handling.

B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.

C. Store rolled materials on end in original packaging. Protect rolls from direct sunlight and weather until ready for use.

D. Store air barrier membranes, adhesives and primers at temperatures of 40 degrees F and rising. Remove and replace liquid materials that cannot be applied within their stated shelf life.

E. Wasted Management and Disposal:
   1. Separate and recycle waste materials in accordance with Section 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

F. Contractor to verify compliance for Volatile Organic Compounds (VOC) limitations of products to comply with all federal, state and local regulations controlling use of volatile organic compounds (VOCs).

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

B. Ensure continuity of the specified membranes throughout the scope of this section.
   1. Air barrier membrane to include self-adhered air barrier, transition membranes and sealant at penetrations.
   2. Drainage plane to include water resistive barrier and flexible flashings to exterior.

1.11 WARRANTY

A. Provide manufacturer’s standard 12-year material warranty for air barrier membrane materials, sealant and flashing membrane.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Water Resistive Air Barrier: shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
   1. Air-Barrier Assembly Air Leakage: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.
   2. Tested to ASTM E2357 for Air Leakage of Air Barrier Assemblies,
   3. Resistance to Water Penetration: Pass ICC-ES AC 38
   4. Water Penetration Resistance around Nails: Pass when tested to AAMA 711-05 & ASTM D1970/D1970M.
   5. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84: Flame Spread Rating of 15 and Smoke Development Classification of 45,
   6. Basis Weight: Minimum 160 gm/m2, when tested in accordance with TAPPI Test Method T-410,
   7. Tensile Strength: 40 lb ft MD and 29 lb ft CD per ASTM D828,

8. Average Dry Breaking Force: 127 lb ft MD, and 91 lb ft CD per ASTM D 5034,
9. Cyclic and Elongation: Pass at 100 cycles, -29 degrees C (-20 degrees F) per ICC-ES AC 48

2.03 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick, cross-laminated polyethylene film with release liner on adhesive side and formulated for application with primer that complies with VOC limits of authorities having jurisdiction.
   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. Carlisle Coatings & Waterproofing Inc.; CCW-705.
      b. Grace, W. R. & Co. - Conn.; Perm-A-Barrier Wall Membrane.
      c. Henry Company; Blueskin SA or SA LT.
      d. Tremco Incorporated, an RPM company; ExoAir 110/110LT.
      e. 3M Corporation - 3015.
   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
      b. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.
      c. Puncture Resistance: Minimum 40 lbf (180 N); ASTM E 154.
      d. Vapor Permeance: Maximum 0.05 perm (2.9 ng/Pa x s x sq. m); ASTM E 96/E 96M, Water Method.

2.04 ACCESSORY MATERIALS

A. General: Accessory materials recommended by air-barrier manufacturer to produce a complete air-barrier assembly and compatible with primary air-barrier membrane.

B. Self-adhering membrane for window sill pan flashings: Blueskin SA, LT manufactured by Henry; an SBS modified bitumen, self-adhering sheet membrane which is integrally laminated to a blue polyethylene film. Membrane shall have the following physical properties:
   1. Membrane Thickness: 0.040 inches,
   2. Low temperature flexibility: -30 degrees F to ASTM D146,
   3. Elongation: 200% minimum to ASTM D412-modified,
   4. Minimum Puncture Resistance 40lbf to ASTM E154,
   5. Lap Peel Strength 10 lbf/in width to ASTM D903 180° bend,
   6. Auxiliary tested component of ASTM E2357 for Air Leakage of Air Barrier Assemblies

C. Self-adhering membrane for all window jambs, headers, door openings, inside and outside corners, and other transitions: Blueskin VPTM 160 manufactured by Henry or approved equal; a self-adhering sheet air barrier membrane with an engineered film specifically designed to be water resistant and vapor permeable. Membrane shall have the following physical properties:
   1. Air leakage: <0.004 CFM/ sq. ft. @ 1.57 lbs/ sq. ft. when tested in accordance with ASTM E2357.
   2. Water Vapor Permeance: 0.03 perms to ASTM E96, Method B,
   3. Tested to ASTM E2357 for Air Leakage of Air Barrier Assemblies,
   4. Resistance to Water Penetration: Pass ICC-ES AC 38,
   5. Water Penetration Resistance around Nails: Pass when tested to AAMA 711-05 & ASTM D1970 modified,
   6. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84: Flame Spread Rating of 15 and Smoke Development Classification of 45,
   7. Basis Weight: Minimum 160 gm/m2, when tested in accordance with TAPPI Test Method T-410,

8. Tensile Strength: 40 lb ft MD and 29 lb ft CD per ASTM D828,
9. Average Dry Breaking Force: 127 lb ft MD, and 91 lb ft CD per ASTM D 5034,
10. Cyclic and Elongation: Pass at 100 cycles, -29 degrees C (-20 degrees F) per ICC-ES AC 48

D. Substrate-Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

E. Adhesive Primers: Low VOC adhesive primer for primary self-adhering water resistive air barrier membrane, self-adhering transition membrane and SBS modified bitumen membranes at all temperatures shall be Blueskin LVC Adhesive as supplied by Henry or approved equal; a low V.O.C. quick setting rubber based adhesive. Adhesive Primer shall have the following physical properties:
1. Color: Blue,
2. Weight: 7.68 lbs/gal,
3. Solids by weight: 40%,
4. Max. V.O.C. <240 grams/liter,
5. Drying time (initial set): 30 minutes at 50% RH and 70 degrees F

F. Elastomeric Flashing Sheet: Through-wall flashing membrane (Self-Adhering) shall be Blueskin TWF manufactured by Henry or approved equal; an SBS modified bitumen, self-adhering (Yellow) sheet membrane complete with a cross-laminated polyethylene film. Membrane shall have the following physical properties:
1. Membrane Thickness: 0.0394 inches (40 mils),
2. Film Thickness: 4.0 mils,
3. Flow (ASTM D5147): Pass @ 212 degrees F,
4. Puncture Resistance: 134 lbf , ASTM D5635.
5. Tensile Strength (film): 5723 psi, ASTM D882,
6. Tear Resistance: 13lbs. MD, ASTM D1004,
7. Low temperature flexibility: -22 degrees F, CGSB 37-GP-56M

G. Penetration and Termination Sealant: HE925 BES Sealant manufactured by Henry; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
1. Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
2. Complies with ASTM C920, Type S, Grade NS, Class 25,
3. Elongation: 450 - 550%,
4. Remains flexible with aging,
5. Seals construction joints up to 1 inch wide,
6. Auxiliary tested component of ASTM E2357 for Air Leakage of Air Barrier Assemblies.

H. Insulation adhesive: Air-Bloc 21 Insulation Adhesive manufactured by Henry; a synthetic, trowel applied, rubber based adhesive, having the following physical properties:
1. Compatibility: With air barrier membrane, substrate and insulation,
2. Air leakage: 0.0026 CFM/ft2 @ 2.1 lbs/ft2 to ASTM E283,
3. Water vapor permeance: 0.03 perms to ASTM E96,
4. Long term flexibility: CGSB 71-GP-24M

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.

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

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier 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 in concrete with substrate-patching membrane.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM C920.

3.03 INSTALLATION

A. General: Install modified bituminous sheets and accessory materials according to air-barrier manufacturer's written instructions and according to recommendations in ASTM D 6135.
   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 air-barrier sheet produced for low-temperature application. Do not install low-temperature sheet if ambient or substrate temperature is higher than 60 deg F (16 deg C).

B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135

C. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhering water resistive air barrier transition membrane.

D. For the application of SBS modified self-adhering window sill pan flashings, through-wall flashings and other applications of SBS modified self-adhering transition membranes, the substrate needs to be conditioned with applicable adhesive primer.

E. Apply adhesive primer at rate recommended by manufacturer to all areas to receive SBS modified self-adhering sheet membrane as indicated on drawings by roller or spray and allow to dry.

F. For applications of SBS modified self-adhered membranes installed over the primary self-adhered water resistive air barrier membrane, the surface of the primary self-adhered water resistive air barrier membrane must be primed and allowed to cure prior to the placement of the SBS modified self-adhered membrane.

G. Apply adhesive primer as required on surface of WRAB (Water Resistive Air Barrier) where subsequent WRAB membrane will overlap such as selvage edge and end laps.

H. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier. Accurately align sheets and maintain uniform 2-1/2-inch minimum lap widths and 3 inch minimum end laps. Overlap and seal seams, and stagger end laps to ensure airtight installation.

1. Apply sheets in a shingled manner to shed water without interception by any exposed sheet edges.
2. Roll sheets firmly to enhance adhesion to substrate.

I. Seal top of through-wall flashings to air-barrier sheet with an additional 6-inch (150-mm) wide, strip.

J. Seal exposed edges of sheet at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

K. Install air-barrier sheet and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
1. Coordinate air-barrier installation with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.

L. Connect and seal exterior wall air-barrier membrane continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

M. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply elastomeric flashing sheet so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
1. Place specified SBS modified self-adhering window sill pan flashing membrane across window sills. Pre-treat inside corners with a bead of termination sealant. Install window sill pan membrane and end dam terminations, seal cuts and terminations with termination sealant.
2. Wrap jamb of rough openings with specified self-adhering water resistive air barrier transition membrane as detailed.
3. Extend specified self-adhering water resistive air barrier membrane into rough window openings sufficient to provide a connection to interior vapor retarder.
4. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over exposed edges and on cavity side of flashing sheet.

N. At end of each working day, seal top edge of air-barrier material to substrate with termination mastic.

O. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
1. Seal membrane terminations, heads of mechanical fasteners, masonry tie fasteners, around penetrations, duct work, electrical and other apparatus extending through the primary water resistive air barrier membrane and around the perimeter edge of membrane terminations at window and door frames with specified termination sealant.
2. Seal the leading edge of membrane terminations and reverse laps.

P. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.

Q. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

R. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections shall include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Continuous structural support of air-barrier system has been provided.
   3. Site conditions for application temperature and dryness of substrates have been maintained.
   4. Maximum exposure time of materials to UV deterioration has not been exceeded.
   5. Surfaces have been primed.
   6. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction and mastic applied on exposed edges, with no fishmouths.
   7. Termination mastic has been applied on cut edges.
   8. Air barrier has been firmly adhered to substrate.
   9. Compatible materials have been used.
   10. Transitions at changes in direction and structural support at gaps have been provided.
   11. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   12. All penetrations have been sealed.

C. Tests: As determined by Owner's testing agency from among the following tests:
   1. Qualitative Air-Leakage Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization.

D. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

3.05 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. If exposed to these conditions for more than 30 days, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed membrane according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, 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 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, but is not limited to, the following:
   1. Infiltration Barrier (Weather Resistive Barrier).
   2. Window, Door, Louver & Transition Flashing
   3. Air Barriers.
   4. Vapor Retarders.
   5. Sill Sealer.
   6. Foam Closure Strip at Metal Roof Decking.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Section 031000 - Concrete Forming and Accessories for vapor barrier/insulation under interior slabs on grade.
   2. Section 053100 - Steel Decking
   3. Section 054000 - Cold Formed Metal Framing.
   4. Section 061643 - Gypsum Sheathing
   5. Section 075323 - Fully Adhered EPDM Roofing Systems for vapor retarder specified as part of the EPDM Roofing System.
   6. Section 075323.11 - Self-Adhering EPDM Roofing System for vapor retarder specified as part of the EPDM Roofing System.
   7. Section 075419 - Polyvinyl-Chloride (PVC/TPA) Roofing for vapor retarder specified as part of the PVC/TPA Roofing System.
   8. Section 076200 - Sheet Metal Flashing and Trim
   9. Section 079200 - Sealants

1.03 STANDARDS AND REFERENCES

A. ASTM International
   1. ASTM D 882; "Standard Test Method for Tensile Properties of Thin Plastic Sheeting".
   2. ASTM D 1117; "Standard Guide for Evaluating Non-woven Fabrics".
   3. ASTM E 84; "Standard Test Method for Surface Burning Characteristics of Building Materials".
   4. ASTM E 96; "Standard Test Methods for Water Vapor Transmission of Materials".
   5. ASTM E 1643; " Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs".
   6. ASTM E 1677; "Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls".
   7. ASTM E 2178; "Standard Test Method for Air Permeance of Building Materials".
   8. ASTM E 2357; "Standard Test Method of Determining Air Leakage Rate of Air Barrier Assemblies".

B. AATCC - American Association of Textile Chemists & Colorists
   1. Test Method TM127; "Test Method for Water Resistance: Hydrostatic Pressure".

C. TAPPI - Technical Association of the Pulp and Paper Industry
   1. Test Method T-460; "Air Resistance of Paper (Gurley Method)".

1.04 SUBMITTALS

A. Submit pursuant to Section 013300 - Submittal Procedures.

B. Submit pursuant to Section 016000 - Product Requirements.

C. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations.

D. Manufacturer's field service reports for infiltration barrier: Provide pre-installation conference and site reports from authorized field service representative, indicating observation of infiltration barrier assembly installation.

E. Infiltration Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion:
   1. Warranty Period: 10-year limited product and labor warranty.

1.05 PRE-INSTALLATION MEETING

A. Hold a pre-installation conference, two weeks prior to start of infiltration barrier installation. Attendees shall include Contractor, Architect, installer, Owner's Representative, and infiltration barrier manufacturer's designated representative.

B. Review all related project requirements and submittals, status of substrate work and Preparation, areas of potential conflict and interference, availability of infiltration barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordination of methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Store materials as recommended by manufacturer.

PART 2 PRODUCT

2.01 VAPOR RETARDER

A. Wall and Ceiling
   1. Vapor Retarder shall be six (6) mil. polyethylene for exterior wall locations, bottom of trusses in attic locations and other locations shown on the Contract Drawings.

B. Under slab on grade
   1. See Section 031000 - Concrete Forming and Accessories

2.02 INFILTRATION BARRIER

A. Infiltration barrier DuPont™ Tyvek® DrainWrap™ or an Architect Approved Equivalent shall be installed over all exterior wall sheathing.
   1. Air Penetration: .004 cfm/ft2 at 75 Pa maximum when tested in accordance with ASTM E2178. Type 1 when tested in accordance with ASTM E-1677.
   2. Water Vapor Transmission: 36 perms, when tested in accordance with ASTM E96, Method A

3. Water Penetration Resistance: 210 cm when tested in accordance with AATCC Test Method 127.
4. Basis Weight: 2.1-oz/yd2 min., when tested in accordance with TAPPI Test Method T-410.
5. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 5, Smoke Developed: 25.
6. Infiltration Barrier to be made of spunbonded polyolefin, non-woven, non-perforated infiltration barrier (weather barrier).
    a. Infiltration barrier to be covered within four (4) months of installation.

B. Tape: 3” wide pressure sensitive tape of type recommended by manufacturer for sealing joints and penetrations in infiltration barrier.

C. Fasteners: DuPont Tyvek Wrap Cap Screws, as distributed by DuPont: 1-5/8” rust resistant screw with 2” diameter plastic cap or manufacturer approved equivalent.

2.03 WINDOW, DOOR, LOUVER AND TRANSITION FLASHING (WDLT FLASHING)

A. Manufacturers:
1. Henry Company Blueskin® SA if continuous insulation is a board type insulation and Blueskin® Metal Clad® if continuous insulation is a spray foam insulation.
2. Carlisle Coatings & Waterproofing CCW-705 XLT Strips if continuous insulation is a board type insulation and CCW Aluma-Grip™ 701 if continuous insulation is a spray foam insulation.
3. If Fluid-applied Air and Vapor Barriers (Section 072726) are being utilized, provide window and door flashings of the same manufacturer.

B. Primer: As recommended by manufacturer.

C. Accessories:
1. Termination Bar: 1/8” x 1”, 304 stainless steel, continuous, fastened at 16” o.c. where shown on Contract Drawings or required to ensure permanent attachment to substrate.

2.04 AUXILIARY SEALING MATERIALS

A. SILL SEALER
1. Install high-density Polyethylene foam sill sealer under bottom track at all exterior stud walls. Sealer to be full width of track.
    a. Owens Corning® ProPink ComfortSeal™ Sill Gasket.
    b. PolySeal™ Sill Sealer by Plymouth Foam.
    c. Reflectix® Sill Sealer by Reflectix, Inc..
    d. Styrofoam™ Brand Sill Seal by Dupont.

B. FOAM CLOSURE STRIPS
1. Provide top and bottom void strip foam closures by Metal Deck.com or Architect approved equivalent.
2. Foam Closure Strips to be manufactured to match the profile of the roof deck.
3. Install in top and bottom flutes of all roof decking at perimeter envelope insulation as shown on Contract Drawings.

PART 3 EXECUTION

3.01 VAPOR TIGHTNESS

A. No tears or gaps in the vapor retarder and infiltration barrier will be allowed. Repair any tears or punctures in barriers immediately BEFORE CONCEALMENT by other work. Cover tape or add another layer of vapor/infiltration barrier.

B. Vapor retarders are to be installed over all exterior wall batt insulation, uninterrupted from slab to roof deck or as detailed on Contract Drawings. Vapor retarders are to be installed under all attic insulation (insulation located between the roof trusses).
   1. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
   2. Overlap joints a minimum of 24".
   3. Overlapped joints shall be completely covered with adhesives or tape per vapor barrier/retarder manufacturer's printed directions. Locate all joints over framing members or other solid substrates.
   4. All attic insulation shall be installed prior to placement of the vapor retarder below the insulation.
   5. See Contract Drawings foe vapor retarder sealing at edge terminations.

C. The joint between the exterior wall Gypsum Wall Board and the roof deck shall be sealed against air infiltration. The exterior wall Gypsum Wall Board shall overlay the bottom plate. Use foam closure strips specified above in both top and bottom flutes behind the exterior wall gypsum sheathing.

3.02 AIR TIGHTNESS

A. Infiltration Barrier
   1. All joints in the infiltration barrier will be lapped a minimum of six (6) inches and sealed with an approved construction tape. Overlap infiltration barrier at exterior corners a minimum of 12 inches.
   2. The infiltration barrier shall be neatly folded into each building opening in a manner to eliminate any gaps in the continuous airtight surface.
   3. Any terminating edges of the infiltration barrier, such as at the top or bottom of the wall shall be sealed with caulk.
   4. All penetrations shall be fully sealed per manufacturer's recommendations.
   5. Seal any tears or cuts as recommended by infiltration barrier manufacturer.
   6. Notify manufacturer's designated representative to obtain required periodic observations of infiltration barrier installation.

B. It is intended that the building be as airtight as practical.
   1. It is incumbent upon the contractor to notify the Architect of any conflict or problem, so the Architect may make revisions or modifications to the work.
   2. Notify Architect and allow 48 hours (minimum) for inspection of the insulation and vapor barrier prior to covering or sealing of the work.

3.03 WINDOW, DOOR, LOUVER AND TRANSITION FLASHING (WDLT FLASHING)

A. Surface Preparation
   1. All surfaces must be clean of oil, dust and excess mortar. Strike masonry joints flush.
   2. Prime all surfaces to receive flashing in accordance with manufacturer's recommendations.

B. Installation
   1. Lap flashing a minimum of 2" on both side and end laps. Orient laps shingle fashion to shed water. Seal joints in accordance with manufacturer's recommendations.
   2. Membrane applied to the underside of the substrate (i.e. ceilings) requires mechanical fastening with termination bars.
   3. Install termination bar where shown on the contract documents or required to insure permanent adhesion to substrate.
   4. Where spanning a change in substrates, beam, column, brace, etc., flashing shall extend onto each surface a minimum of 4" on each side of the discontinuity.

C. Locations
   1. Install at all window, door, louver, duct, pipe, conduit penetrations of the exterior gypsum/wood sheathing or exterior CMU back-up masonry.
   2. Install at all inside and outside corners of exterior gypsum/wood sheathing.
   3. Transition flashing shall span any discontinuity between exterior wall back-up materials. These can be vertical, horizontal and/or diagonal. Examples are:
      a. Gypsum/wood sheathing terminates at start of exterior CMU back-up with both materials in the same plane.
      b. Gypsum/wood sheathing overlaps exterior CMU back-up and terminates.
      c. Exterior CMU back-up wall is not continuous due to a steel column, beam and/or brace.
      d. Exterior gypsum/wood sheathing is not continuous due to a steel column, beam and/or brace.
   4. At all other locations shown on Contract Drawings.

3.04 PROTECTION

A. General: Protect installed insulation, infiltration barriers, WDLT flashings and vapor barriers from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

B. Protect WDLT flashings from sunlight as quickly as possible. Exposure to sunlight shall be limited to six weeks or as recommended by manufacturer in writing.

END OF SECTION

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 - SHEET METAL WORK, 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 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.

2.02 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. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. 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 air barrier and vapor retarder UNDER jamb flashings.
7. Install head flashings under weather barrier.
8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

D. 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.

E. 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 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, but not limited to, the following:
   1. Installation of a fluid-applied air and water-resistive barrier via spray application to all exterior CMU back-up walls.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Section 040523 - Masonry Accessories
   2. Section 042200 - Concrete Unit Masonry for requirement that backup masonry joints are flush and completely filled with mortar, and that excess mortar on veneer ties will be removed; requirement for gap at deflection joints and fillers; coordination with sequencing of through-wall flashing.

1.03 REFERENCES

A. ASTM D412 "Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension".

B. ASTM D4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method".

C. ASTM D4541 "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers".

D. ASTM E84 "Standard Test Method for Surface Burning Characteristics of Building Materials".

E. ASTM E96 "Standard Test Methods for Water Vapor Transmission of Materials".

F. ASTM E2178 "Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials".

G. ASTM E2357 "Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies".

1.04 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02L/m2 @ 75 Pa.) when tested according to ASTM E 2178.

B. Connections to Adjacent Materials: Provide connections to prevent air leakage and vapor migration at the following locations:
   1. Foundation and walls, including penetrations, ties and anchors.
   2. Walls, windows, curtain walls, storefronts, louvers or doors.
   3. Different wall assemblies and fixed openings within those assemblies.
   4. Wall and roof connections and penetrations.
   5. Expansion joints,
   6. All other leakage pathways in the building envelope.

1.05 SUBMITTALS

A. Submit pursuant to Section 013300 - Submittal Procedures

B. Submit pursuant to Section 016000 - Product Requirements.

C. Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program.
   1. Submit accreditation number of manufacturer.
   2. Air barrier installer shall be currently accredited under the ABAA and ensure applicators are certified in accordance with the ABAA Quality Assurance Program.

D. Product Data: Submit manufacturer's product data, installation instructions and manufacturer's printed instructions for evaluation, preparing and treating substrate, temperature and other limitations of installation conditions, technical data and tested physical and performance properties.
   1. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
   2. Include statement that materials are compatible with adjacent materials proposed for use.

E. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

1.06 QUALITY ASSURANCE

A. Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance with the ABAA Quality Assurance Program.

B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air and vapor barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

C. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

D. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials and details of construction. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

E. Field Quality Assurance: Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air and vapor barrier until it has been inspected, tested and accepted.

F. Mock-Ups: Build mock-up representative of primary exterior wall assemblies including backup wall and typical penetrations as acceptable to the Architect. Mock-up shall be part of masonry sample panel.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air and vapor barrier membrane manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with manufacturer's recommendations.

1.08 PROJECT CONDITIONS

A. Temperature: Install air and vapor barrier within range of ambient and substrate temperatures recommended by air and vapor barrier manufacturer.

B. Field Conditions: Do not install air and vapor barrier in snow, rain, fog or mist without temporary protection and supplemental heat as required. Do not install air and vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or in accordance with manufacturer's recommendations.

C. Minimize UV exposure to three months maximum (unless manufacturer dictates a shorter duration) as the product is not intended for uses subject to abuse or permanent exposure to the elements.

1.09 WARRANTY

A. Material warranty: Provide manufacturer's standard product warranty, for a minimum of three (3) years from date of Substantial Completion.

B. Installation Warranty: Provide installer's 2-year warranty form date of Substantial Completion, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 PRODUCT

2.01 MATERIALS

A. Fluid-Applied Air and Vapor Barrier: Fluid-applied proprietary materials as specified. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant recommended by manufacturer. Subject to compliance with requirements, provide one of the following:
   1. Carlisle Coatings and Waterproofing:
      a. Fluid-Applied Air and Vapor Barrier: Barriseal, 40 mils thick (dry)
      b. Water-Based Primer: CCW-AWP Water-Based Primer.
      c. Solvent-Based Primer: CCW-702 Solvent-Based Primer.
      d. Solvent-Based Aerosol Primer: CAV-GRIP
      e. Mastic: CCW-704 Solvent-Based Rubberized Asphalt Mastic
      f. Sealants: CCW-703 Vertical Grade Liquiseal membrane or CCW-201 two component polyurethane sealant.
      g. Counterflashing for Masonry Through-Wall Flashings: CCW-705.
      h. Website: www.carlisle-ccw.com
   2. GCP Applied Technologies:

a. Fluid-Applied Air and Vapor Barrier: Perm-A-Barrier® Liquid, 60 mils thick (wet).
b. Water-Based Primer: Perm-A-Barrier® WB Primer.
c. Solvent-Based Primer: Bituthene Primer B2 and Bituthene Primer B2 LVC.
d. Through-Wall Flashings or Shelf Angle Flashings: Perm-A-Barrier® Wall Flashing.
e. Mastics, Adhesive and Tapes: As recommended by GCP Applied Technologies.
f. Transition Strip: Perm-A-Barrier® Detail Membrane and Perm-A-Barrier® Wall Flashing.
g. Transition Strip: Bituthene Primer B02
h. Termination Mastic: Bituthene Liquid Membrane and as recommended by GCP Applied Technologies.
i. Window Flashings and Detail Membrane: Perm-A-Barrier® Detail Membrane and Perm-A-Barrier Wall Flashing.

3. Tremco, Inc.: www.tremcosealants.com
   a. Fluid-Applied Air and Vapor Barrier: ExoAir 120SP (spray-applied) and ExoAir 120R (roller-grade), 60 mils (wet) (25 square feet per gallon for sheathing panels and 20 square feet per gallon for unparged masonry walls).
   b. Water-Based Primer: ExoAir WB Primer
   c. Solvent-Based Primer: ExoAir Primer or GM Primer or ExoAir 10 Primer as recommended.
   d. Counterflashing for Masonry Through-Wall Flashings: ExoAir TWF.
   e. Mastics, Adhesives and Tapes: As recommended by manufacturer.
4. Sto Corp: www.stocorp.com
   a. Primary Air Barrier Material: StoGuard VaporSeal - ready-mixed flexible spray or roller applied waterproof air barrier and vapor barrier membrane material.
   b. Accessory Materials
      1) Joint and Rough Opening Treatments
         (a) Sto Gold Fill® with StoGuard Mesh: ready-mixed flexible trowel or spray applied air barrier material.
         (b) StoGuard Rapid Seal™ with StoGuard Mesh: moisture cure elastomeric waterproof air barrier material (mesh not required at rough openings).
         (c) Sto VaporSeal with StoGuard Fabric: flexible waterproof air barrier and vapor barrier membrane material.
         (d) StoGuard Tape: self-adhering rubberized asphalt tape with polyester fabric facing (for rough openings only).
      2) Joint Reinforcements
         (a) StoGuard Mesh: nominal 4.2 oz/yd2 self-adhesive, flexible, symmetrical, interlaced glass fiber reinforcing mesh, with alkaline resistant coating for compatibility with Sto materials.
         (b) StoGuard Fabric: non-woven integrally reinforced cloth reinforcement.
         (c) StoGuard RediCorner™: non-woven integrally reinforced pre-formed cloth.
      3) Transition Membranes
         (a) Sto Gold Fill with StoGuard Mesh: ready-mixed flexible trowel or spray applied air barrier material with treated glass fiber reinforcing mesh.
         (b) StoGuard RapidSeal or StoGuard RapidSeal with StoGuard Mesh: moisture cure elastomeric waterproof air barrier material with treated glass fiber reinforcing mesh (where applicable).
         (c) Sto VaporSeal with StoGuard Fabric: flexible waterproof air barrier membrane material with non-woven integrally reinforced cloth.
         (d) StoGuard Tape: self-adhering rubberized asphalt tape with polyester fabric facing.
      4) Primers
         (a) StoGuard Primer: rubber resin emulsion primer for use with StoGuard Tape to enhance adhesion and allow installation down to 35° F.
5. W. R. Meadows®, Inc.: www.wrmeadows.com.
   a. AIR-Shield™ LSR.

b. Patching material for all cracks, voids, irregularities and small deformities: MEADOW-PATCH® 5 or MEADOW-PATCH® 20.
c. Primers, mastics, sealants, flashings as recommended by W.R. Meadows for a complete system.

6. Architect Approved Equivalent.

2.02 AUXILIARY MATERIALS

A. Sealant at Transitions in Substrate and Connections to Adjacent Elements: Low-modulus pre-cured silicone extrusion and sealant for bonding extrusions to substrates; Tremco Silicone Extruded Sheet by Tremco, Spectrem EZ Seal by Tremco, Sika® Silbridge-300 by SIKA USA, or approved product of the air barrier manufacturer.

B. Transition Membrane between Air and Vapor Barrier Membrane and Roofing and Other Adjacent Materials: Comply with both air and vapor barrier manufacturer's recommendations and roofing material manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions under which air and vapor barrier assemblies will be applied, with Installer present, for compliance with requirements.
1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
2. Do not proceed with installation until after minimum concrete curing period recommended by air and vapor barrier manufacturer.
3. Ensure that the following conditions are met:
a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants.
b. Concrete surfaces are cured and dry, smooth and without large voids, spalled areas or sharp protrusions.
c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.
5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.
6. Notify Architect in writing of anticipated problems using air and vapor barrier over substrate prior to proceeding.

3.02 SURFACE PREPARATION

A. Clean, prepare and treat substrate according to manufacturer's written instructions. Mask off adjoining surfaces to prevent overspray and spillage.

B. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:
1. Prime masonry, concrete substrates with conditioning primer.
2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
3. Prime wood, metal and painted substrates with primer.
4. Prepare, treat and seal vertical and horizontal surfaces at terminations and penetrations through air and vapor barrier and at protrusions.

C. Prime substrate for application of fluid-applied air and vapor barrier if recommended by manufacturer based on project conditions and as follows.

3.03 INSTALLATION

A. Air and Vapor Barrier Installation: Install transition strip materials and fluid-applied air and vapor barrier to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or requirements of their recommended materials:
   1. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.
   2. Apply primer for fluid-applied air and vapor barrier as recommended by fluid-applied air and vapor barrier manufacturer. Based on manufacturer's recommendation, no primer may be required for the fluid-applied materials.
   3. Apply fluid-applied air and vapor barrier using equipment and methods recommended by manufacturer, to achieve a dry film thickness as recommended by the manufacturer.
   4. Apply fluid-applied air and vapor barrier and transition strips to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.
   5. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches (50mm), unless greater overlap is recommended by manufacturer. Roll into place with roller.
   6. Overlap horizontally adjacent pieces of transition strips a minimum of 2 inches (50mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.
   7. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.
   8. Connect air and vapor barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing penetrations, using accessory materials and in accordance with the manufacturer's recommendations.
   9. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.
   10. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to another. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.
   11. At through-wall flashings, provide an additional 6-inch-wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.
   12. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.
   13. At expansion and seismic joints provide transition to the joint assemblies.
   14. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts and as recommended by the manufacturer.
   15. At end of each working day, seal top edge of membrane to substrate with termination mastic.
   16. Do not allow materials to come in contact with chemically incompatible materials.
   17. Do not expose membrane to sunlight longer than is recommended by the manufacturer.
   18. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.04 FIELD QUALITY CONTROL

A. Owner's Inspection and Testing: Cooperate with Owner's testing agency. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule of Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

3.05 PROTECTING AND CLEANING

A. Protect air and vapor barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Coordinate with installation of materials which cover air and vapor membrane, to ensure exposure period does not exceed that recommended by the air and vapor barrier manufacturer or stated above.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

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 - SHEET METAL WORK, 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, applicable provisions of the "Conditions of the Contract" and Division 01 Specification Sections apply to this section.

1.02 WORK INCLUDED

A. The work includes all labor, materials, equipment and appliances required for the complete installation of all work of this section and related work as indicated on Drawings, specified herein and as required by conditions encountered at the site, including but not limited to the following:
   1. Composite fiberglass panel system at exterior facade including but not limited to fascias, infill panels and elsewhere indicated on Drawings.

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; 2019.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

D. ASTM D6638 - Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks); 2018.

E. 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.

F. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008 (Reapproved 2015).

G. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.

H. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2020.

I. 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).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.04 PERFORMANCE / DESIGN REQUIREMENTS

A. General Performance: Exterior Composite fiberglass panel system shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance: Exterior Composite fiberglass panel system shall withstand the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E330/E330M.

1. Panels shall be designed to withstand the Design Wind Load based upon the Basic Wind Speed of 120 miles per hour (mph), but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this listed standard.
2. Movement caused by an ambient temperature range of 120 degrees F and a surface temperature range of 160 degrees F.

C. System design to be performed by qualified professional engineer licensed in State of New York.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide products by a manufacturer with experience completing at least five projects of the size, scope and quality required by this project within the last five (5) years. Provide all composite architectural panels by a single manufacturer.

B. Installer Qualifications: Not less than three (3) years of successful experience in completing exterior cladding systems similar in material and scope to this project.
1. Approved by composite stone wall panel manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of installation techniques and finished appearance.
1. Finish areas designated by Architect/Engineer.
2. Do not proceed with remaining work until workmanship and overall appearance are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.
4. Approved mock-up may be incorporated into the completed work.

1.06 SUBMITTALS

A. Submit under provisions of Section 013300 - SUBMITTALS.

B. Product Data: Manufacturer’s data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Include elevations and detail sections of installation. Include cutting and setting drawings indicating sizes, dimensions, sections, and profiles of panels; arrangements and provisions for jointing, supporting, anchoring, and bonding panels; and details showing relationship with, attachment to, and reception of related work. Include large-scale details of each system component, anchorage, and fastening device.

D. Engineering Calculations: Submit engineering calculations that bear the stamp of a Professional Engineer licensed in the State of New York indicating compliance with specified performance criteria including thermal movement and fastener pull-out calculations showing that the installed panels and attachments system meets the wind load requirements for the project. Indicate fastener types and spacing.

E. Selection Samples: Architect/Engineer selection from full range of color and texture combinations.

F. Verification Samples: For each panel specified, two samples, minimum size 6 inches square,
1. representing actual product, color and patterns.

1.07 PRE-INSTALLATION MEETING

A. For all installation systems, convene meeting to review manufacturer’s recommended procedure no less than one week before panel installation is scheduled to begin. Assure attendance by representatives of the Owner's Construction Representative, Architect, Contractor, Installer, and Manufacturer's Field Representative.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver panels in crates on wood pallets, interwoven with protective paper and wrapped in plastic sheets.

B. Store panels flat in original shipping crates or on wood pallets under protective cover until needed for installation. Ventilate coverings to avoid condensation. Elevate above grade on level blocking to avoid standing water.

C. Protect panels from scuffing during handling. Apply manufacturer’s recommended remedial treatment immediately if panels are soiled or scratched or replace panels which can not be restored to the Architect's satisfaction.

D. Carry panels on edge and handle carefully to avoid damage to surfaces and corner.

1.09 WARRANTY/GUARANTEE

A. Manufacturer shall warrant panel to be free from delamination, cracking, crazing or peeling and for structural integrity for twenty (20) years from date of acceptance of the work.

B. Contractor shall warrant and guarantee that all work done and materials installed shall remain free from defects of any kind for a period of two (2) years from date of acceptance of the work.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer of Petrarch Architectural Panels: Omnis Panels, Inc; 1717 N. Naper Blvd., Suite 100; Naperville, IL 60563. ASD. Tel: (800) 450-6099 or (630) 355-4040. Fax: (630) 355-4995. Email: info@omnis-panels.com. Website: www.omnispanels.com.

B. Architect approved equivalent.

C. Requests for substitutions will be considered in accordance with provisions of Section 012500 - PRODUCT SUBSTITUTION PROCEDURES

2.02 COMPOSITE FIBERGLASS PANELS

A. Petrarch Panels: 7/16 inch thick composite sheets comprising natural slate and/or stone granules or powder and/or calcium carbonate granules or powder, polyester resin, glass fiber, pigments, and fire retardant, with homogeneous color throughout.
   1. Weight: 4.5 lb/sq ft.
   2. Texture: Riven Slate, Riven Matt, and Smooth Matt
   3. Color: as selected by the Architect from the manufacturer's full color offering..
   4. Width: 47-3/4 inches.
   5. Length: 95-3/4 inches.
   6. Length: 119-3/4 inches.
   7. Density: 2.27, per ASTM D 792.

8. Modulus of Rupture: 5,690 psi (39.2 MPa), when tested in accordance with ASTM D790.
9. Tensile Strength: 2960 psi (20.4 MPa), when tested in accordance with ASTM D638.
10. Thermal Conductivity: 5.822 BTU-in/hr sq ft (120.8 W/m K), when tested in accordance with ASTM C177
11. Izod Impact: 0.43 ft-lb/in (0.008 J/m) of notch, when tested in accordance with ASTM D256.
12. Hardness Barcol: 64, when tested in accordance with ASTM D785
13. Flame Spread: 15, when tested in accordance with ASTM E84.
14. Fuel Contribution: 0, when tested in accordance with ASTM E84.
15. Moisture Absorption: Maximum 0.2 percent by weight after 24 hours of immersion.
16. Biological Resistance: Immune to insect and vermin attack; inhibits mold growth.
17. Chemical Resistance: Impervious to most acid and organic solvents.

B. Manufacturing Tolerances:
   1. Sheet size tolerance: Plus or minus 1/8 inch
   2. Thickness tolerance: Plus or minus 1/16 inch

2.03 SETTING SYSTEMS:

A. Structural Silicone Setting System:
   1. Aluminum Bearing Plates: 80% recycled 6063-T5 alloy, 0.125 in thickness, Clear Anodized.
   2. Bearing Plate Fasteners: No. 8 x 1-1/2 inch, pan head, Stainless Steel screws.
   3. Structural Silicone: One-component structural silicone glazing sealant: SikaTack Panel 50 by Sika Corporation or type otherwise recommended by the composite stone panel manufacturer.
   4. Cellular Foam Tape: Norton V2100 Series Thermal bond, P2106 Black, 3/16 inch by 1/2 inch or type and size otherwise recommended by the composite stone panel manufacturer.
   5. Adhesion Promoter: Norton Tite-R-Bond (2287) or Type otherwise recommended by the composite stone panel manufacturer.
   6. Setting Blocks: Silicone, 80-90 Shore A durometer, 1/8 inch by 11/32 inch by 4 inches or size otherwise recommended by the stone panel manufacturer.

2.04 ACCESSORIES:

A. Weather Sealant: Silicone or Polyurethane sealant and bond breaker tape as specified in Section 079200 - JOINT SEALANTS.

2.05 FABRICATION

A. Provide factory fabricated panels to the maximum extent possible, conforming to the following:
   1. Cut to custom sizes from manufacturer’s standard sizes
   2. Pre-drill and countersink fastener holes
   3. Prepare special shapes and cutouts
   4. Polish, bevel, or miter edges, as required by the design intent.
   5. Prefabricate inside and outside corners
   6. Prepare inserts and brackets for back fastening system
   7. Bond insulating materials to panels
   8. Engrave as required

B. Perform shop or site cutting using a saw equipped with a dry cut, diamond tipped blade. If using a portable or table saw, place finished side up. If using a moveable, portable skill saw, place finished side down. Clamp to saw bed before cutting. Remove sawdust from panel surface immediately.

C. If on-site drilling or countersinking is required, drill panels with a portable hand-held pistol drill equipped with a drill guide to assure 90 degree holes and a masonry drill bit suitable for drilling at speeds of 900 to 1200 rpm. Remove any sawdust from panel surface immediately.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Measure areas of installation prior to fabrication, to minimize out of square or unbalanced border conditions.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions. Proceed with panel installation only when substrate is completely dry.

3.03 INSTALLATION

A. Install in strict accordance with manufacturer’s instructions. Make adequate provisions for thermal and structural movement.

B. Structural Silicone Setting System:
1. Fasten aluminum bearing plates through sheathing directly to load bearing studs.
2. Apply continuous strips of double-faced, cellular foam tape as spacers and temporary
3. adhesive.
4. Apply beads of structural silicone in a one-panel area, place panel on setting blocks at base,
5. press panel into final position, and block in place until silicone achieves full cure.
6. Install weatherproofing joint sealer in accordance with requirements of Sec. 07 90 00.

3.04 CLEANING AND PROTECTION

A. Clean all panels of dirt, adhesive, and joint sealers, using detergents or solvents as appropriate and as recommended by the manufacturer.

B. Remove and replace any damaged panels and those that cannot be adequately cleaned.

C. Protect installed products until completion of project.

END OF SECTION

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 a thermally broken, rainscreen attachment system for attachment of exterior cladding Metal Wall Panels installed over continuous exterior insulation.

1.03 SYSTEM DESCRIPTION

A. System assembly shall include the following components from the substrate out:
   1. Substrate: Wall framing assembly and sheathing or Concrete masonry unit wall.
   2. Continuous spray foam insulation.
   3. Thermally broken rainscreen attachment system.
   4. Exterior cladding.

B. Design Requirements:
   1. Manufacturer is responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
   2. Employ registered professional engineer, licensed to practice engineering in jurisdiction where Project is located, to engineer each component of rainscreen attachment system.
   3. Structural Design: Exterior-insulated rainscreen wall assembly capable of withstanding effects of load and stresses from dead loads, wind loads, ice loads (if applicable) as indicated on Structural General Notes on Structural Drawings, and normal thermal movement without evidence of permanent defects of assemblies or components.
      a. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum ambient temperatures by preventing overstressing of components and other detrimental effects:
         1) Temperature Change (range): 120 degrees Fahrenheit, ambient.
   4. Support Framing/Attachment System:
      a. No framing component may penetrate the layer of continuous exterior insulation other than thermally isolated fasteners.
      b. Frequency and spacing of stiffened horizontal girts as indicated by manufacture in project specific engineering package.

C. Performance Requirements:
   1. Rainscreen Attachment System Performance: Comply with ANSI/ASHRAE 90.1-2010 definition of continuous insulation (c.i.).
   2. No thermal bridges other than fasteners and service openings.
   3. Thermal Performance:
      a. Full constructed assembly must have a minimum 95% EFFECTIVE R-value when compared to the exterior continuous insulations rated R-value.
      b. Continuous framing profiles (including C- or Z-Shaped sections or furring) penetrating insulation not allowed.
      c. Perform effective R-Value calculation or modeling in accordance with ASHRAE guidelines.
   4. Structural Performance:

a. Framing Members:
   1) Test framing components to AAMA TIR-A8- [04] - Section 7.2 to determine structural performance and effective moment of inertia for each perforated component. Minimum Effective Moment of Inertia: 0.0150 in4.
   2) Localized bending stress for eccentrically loaded framing members must be evaluated with the maximum effective length of resisting element not more than 12 inches.

b. Fasteners:
   1) Tension shall be taken as sum of direct tension plus tension due to prying for eccentrically loaded connections. Prying may be reduced or eliminated if proven via engineering analysis or testing.
   2) Minimum Safety Factor of 3 for both tension and shear values.
   3) Combined tension and shear shall be evaluated according to an interaction formula. Sum of terms shall not exceed 1.0.

1.04 SUBMITTALS

A. Submit pursuant to Section 013300 - Submittal Procedures.

B. Submit pursuant to Section 016100 - Product Requirements.

C. Product Data: Submit manufacturer's product literature and descriptions of testing performed on system components to indicate meeting or exceeding specified performance.

D. Shop Drawings:
   1. Submit connection details to the cladding manufacturer, showing interface of rainscreen attachment system to substrate and panels with adjacent construction, signed and sealed by Professional Engineer.
   2. Show system installation and attachment, including fastener size and spacing.

E. Structural Calculations:
   1. Submit rainscreen attachment manufacturer's comprehensive Structural Design analysis signed and sealed by a Professional Engineer licensed in the state in which the project is located.

F. Samples: Submit following material samples for verification:
   1. Vertical Rails: Two (2) 12-inch long samples.
   2. Horizontal Rails: Two (2) 12-inch long samples.
   3. Wall Brackets: Two (2) samples.

G. Test Reports:
   1. Test to the following standards and provide written test reports by a third party:
      a. AAMA TIR-A8: Structural Performance of Composite Thermal Barrier Framing Systems - Section 7.2.
   2. Comprehensive three-dimensional thermal modeling report indicating framing systems impact on exterior insulation rated R-value.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Minimum 5 years' experience specializing in the manufacturing of façade attachment/support framing like those specified.
   2. Ability to demonstrate conformance to testing requirements.

B. Installer Qualifications:
   1. Minimum of 3 years' documented experience or minimum of 5 completed projects of equivalent scope and quality and recommended by manufacturer to perform work of this Section.

C. Engineer Qualifications: Registered professional engineer experienced in the design of curtain wall systems, anchors, fasteners and licensed to practice engineering in the jurisdiction where Project is located.

D. Pre-Installation Meeting:
   1. Discuss sequence and scheduling of work and interface with other trades.
   2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
   3. Review and document methods, procedures and manufacturer's installation guidelines and safety procedures for exterior wall assembly.

E. Mock-Ups: See detail on Contract Drawings.

1.06 QUALITY CONTROL

A. Single source responsibility:
   1. Furnish engineered rainscreen attachment system components under direct responsibility of single manufacturer.

B. Field Measurements: Verify actual supporting and adjoining construction before fabrication.

C. Record field measurements on project record shop drawings.

D. Established Dimensions: Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of rainscreen attachment system corresponding to established dimensions.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials and components in manufacturer's original, unopened and undamaged containers or bundles, fully identified. Exercise care to avoid damage during unloading, storing and installation.

B. Store, protect and handle materials and components in accordance with manufacturer recommendations to prevent damage, contamination and deterioration. Keep materials clean, dry, and free of dirt and other foreign matter, and protect from damage due to weather or construction activities.

1.08 SEQUENCING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Coordinate construction to ensure that assemblies fit properly to supporting and adjoining construction; coordinate schedule with construction in progress to avoid delaying work.

1.09 WARRANTY

A. Manufacturer Warranties:

1. Attachment System: Ten (10) year Limited Warranty.
    a. Covers components of the attachment system, including structural failure of components when all the materials and components are supplied and installed per manufacturer's requirements.
    b. Includes labor and material for removal and replacement of defective material.
    c. Includes labor to remove and reinstall facade finish panels, finish closures and façade finish accessories necessary to access defective material.

B. Contractor's Warranties: 2-year labor warranty, starting from Substantial Completion, to cover repair of materials found to be defective because of installation errors.

C. Limitation of Warranties: Exclude repairs, replacement, and corrective work to the substrate, primary structure, finish panels, and/or property - unless otherwise noted above. Warranties exclude mechanical damage due to abuse, neglect, primary structure failure, or forces of nature greater than normal weather conditions.

PART 2 PRODUCTS

2.01 INSULATION

A. Refer to Section 072129 - Spray Foam Insulation.

2.02 RAINSCREEN ATTACHMENT/SUPPORT FRAMING SYSTEM

A. Comply with ANSI/ASHRAE 90.1- (Latest Edition).

B. Coating Material: ASTM A1046, Zinc-Aluminum-Magnesium, minimum thickness ZM40.
    1. ASTM A653 Galvanized steel is not acceptable.

C. Steel Classification: Structural Steel (SS), Grade 50, 50 ksi Yield.

D. Spacing: Comply with manufacturer's Professional Engineer's project specific calculations.

E. Wall Brackets:
    1. Minimum 0.074-inch-thick (14 gauge) sheet steel.
    2. Dimensions:
        a. Bracket Base: Minimum 3.125-inch-high by 2.125 inch wide.
        b. Offset Brackets: 3.5-inch depth.
            1) Align offsets to differing wall planes as shown on Contract Drawings.
    3. Pre-Punched Holes: Two (2) wall anchors per bracket.
    4. Recommended Product: ThermaBracket-S by Knight Wall Systems or Designer approved equivalent.

F. Vertical Rail: Nominal 0.046-inch thick (18 gauge), 0.054-inch thick (16 gauge) cold-formed steel.
    1. Profile: C Channel, Two flanges of equal length and one web.
    2. Profile Depth: 1.00 inches.
    3. Pre-Punched Attachment Holes: 1.0 inch on center along length of track and oversized allowing for thermal contraction and expansion of rail without placing stress on brackets.
    4. Recommended Product: S-Rail by Knight Wall Systems or approved equivalent.

G. Secondary Horizontal Rail: Nominal 0.046-inch thick (18 gauge), 0.054-inch thick (16 gauge) cold-formed steel.
   1. Profile: Hat Channel with stiffening lips.
   2. Profile Depth: 0.75 inches.
   3. Girt Fastening Face: Manufacturer's recommendation as Engineered.
   4. Weep Drains: 0.75 inches diameter at 4 inches on center along flanges to allow for free air flow laterally.
   5. Attachment Holes: Locate at 2 inches on center along back to facilitate number 14 self-drilling self-tapping screw attachment to primary rail.
   6. Basis of Design: PanelRail™ by Knight Wall Systems.

H. Fasteners:
   1. Sufficient length to provide solid attachment through sheathing to structure or directly to CMU/Concrete Substrate as required by manufacturer.
   2. Thermal Isolating Washers: Minimum 0.125-inch-thick Polyoxymethylene copolymer (POM) washers with integral entering lip to act as a thermal break between wall anchor fasteners and grit.
      a. Tensile Strength: 9.5 ksi per ISO 527.
      b. Melting Temperature: 329 degrees Fahrenheit per ISO 3146.
      c. Basis of Design: ThermaStop™ Isolator by Knight Wall Systems.
      d. Or System Designer approval equivalent.
   3. Steel stud framing substrate: Self-drill hex-washer-head stainless steel with 1,000-hour salt-spray rated thermoset polyester coating.
      a. Embedment depth: 0.625 inches or three full threads minimum, whichever is greater.
      b. Minimum ultimate pull-out capacity from 18-gauge steel: 450 pounds.
   4. Concrete and concrete masonry units substrate:
      a. Embedment depth: 1.25 inches minimum.
      b. Minimum ultimate pull-out capacity from substrate material: 450 pounds.
      c. ¼ inch Kwik-Con II=by Hilti
      d. ¼ inch Tapcon by Buildex
      e. ¼ inch UltraCon by Elco Industries
      f. Or System Designer approval equivalent
   5. Secondary Vertical Rail to Horizontal Girt Connection: Self-drill hex-washer-head stainless steel with 1,000-hour salt-spray rated thermoset polyester coating.
      a. Embedment depth: 0.625 inches or three full threads minimum, whichever is greater.
      b. Minimum ultimate pull-out capacity from 18-gauge steel: 450 pounds.
   6. Accessories:
      a. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

2.03 SIDING/CLADDING PANEL

A. Refer to Division 07, Section 074213 - Metal Wall Panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with manufacturer requirements for installation conditions affecting performance of the work.

1. Do not proceed with installation until unsatisfactory conditions have been corrected.
2. ThermalStop™ Isolation Assembly and Thermal Brackets are to be installed prior to Spray Foam insulation being installed.
3. Ensure Spray Foam insulation is installed prior to installing horizontal and vertical rails. Ensure ends of Thermal Brackets are cleaned of all Spray Foam residue.
4. Ensure fenestration, transitions, discontinuities, sills, and ledgers are flashed and sealed to move moisture to the exterior of the building.

B. Field verify architectural details and mechanical and electrical requirements prior to commencing installation.

C. Commencement of installation constitutes acceptance of existing conditions and acceptance of responsibility for satisfactory performance.

3.02 RAINSCREEN ATTACHMENT SYSTEM INSTALLATION

A. Installation:
1. Install in strict accordance with manufacturer's installation instructions.
2. Minimum length of installed cut girt is 16-inches and shall be attached with at least two (2) fastening points.
3. Mount stiffened vertical girts, fastened up to 16 inches on center (as required for plywood attachment) using one self-tapping screw with thermal isolator, for each pre-punched attachment hole at spacing indicated on engineering calculations.
4. Secondary Horizontal Rail:
   a. Space to make suitable bearing surfaces for each cladding system as instructed by manufacturer and as shown on Architect accepted Shop Drawings.

3.03 ERECTION TOLERANCES

A. Maximum Framing Member Variation from True Position: ¼- inch.

B. Maximum Framing Member Variation from Plane:
1. Individual Framing Members: Do not exceed ¼-inch in 10 foot.
2. Accumulative Over-all Variation for Wall and Floor System: Do not exceed ¼-inch.

3.04 ADJUSTING

A. Inspect and adjust after installation. Replace or repair defective work.

B. Adjust and reconfigure as necessary to accommodate cladding systems for installations over work of this Section. Do not reuse pre-drilled holes unless fastener size is increased.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fully adhered 60 mil ethylene propylene diene monomer (EPDM) single-ply system utilizing tape seams, and fully adhered flashings with reinforced termination strips on existing cementitious wood fiber roof deck.

B. Tapered roof insulation system. (R=30 minimum)

C. Complete Single-Source membrane roofing system with manufacturer's 20 year, no dollar limit warranty.

D. Vapor barrier at all areas.

E. Flashings and terminations.

F. Roofing membrane expansion joints

G. Walkway pads.

H. Roof drains.

I. Temporary protection against weather

1.02 RELATED SECTIONS

A. Section 024119 - Selective Demolition.

B. Section 055000 - Metal Fabrications.

C. Section 061000 - Rough Carpentry.

D. Section 076200 - Metal Flashing and Trim.

E. Section 086000 - Unit Skylights

1.03 REFERENCES

A. ASTM D4637 - Standard Specification for EPDM Sheet used in Single Ply Roof Membrane

B. ASTM C272 - Test Method for Water Absorption of Core Materials for Structural Sandwich Construction.

C. ASTM C1289 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

D. ASTM D412 - Rubber Properties in Tension.

E. ASTM D624 - Rubber Property - Tear Resistance.

F. ASTM D746 - Brittleness Temperature of Plastics and Elastomeric by Impact.

G. ASTM E96 - Water Vapor Transmission of Materials.

H. Factory Mutual Engineering & Research Corporation (FM) - Roof Assembly Classifications.

I. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.

J. Underwriters Laboratories, Inc. (UL) - Fire Hazard Classifications.

1.04 SYSTEM DESCRIPTION

A. Single Source Elastomeric Sheet Membrane Roofing System: Single ply fully adhered membrane system with insulation.

1.05 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product Data: Provide data for all items to be installed under this specification including, but not limited to, membrane materials, flashing materials, insulation, fasteners, adhesive, miscellaneous system materials, protective covering, and roof walkway pads.

C. Shop Drawings: Indicate setting plan for tapered insulation, mechanical fastener layout, joint or termination detail conditions, conditions of interface with other materials, roof seam layout, direction of laps and flashing details. Shop drawings must be preapproved by system manufacturers.

D. Samples: Submit one sample 12 inches x 12 inches in size illustrating insulation and roofing materials.

E. Manufacturer's Instructions: Indicate special precautions required for seaming the membrane and anchoring the insulation and membrane.

F. Manufacturer's Certificate: Certify that components and products meet or exceed specified standards and comply with referenced standards.

G. Manufacturers Certification, submitted in writing prior to bid date, indicating that applicator has 5 years minimum documented experience, and is a certified installer approved to install the manufacturer’s 20 year roofing system as specified. Failure to provide this submission may result in disqualification of the bidder.

H. Material Safety Data Sheets (MSDS) for all products.

I. Submit Phasing Plan indicating sequence of work to be performed.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Single Source Responsibility: All specified roofing system materials and components shall be supplied and warranted by membrane manufacturer.

C. Regulatory Requirements for Roof Assembly: In compliance with IBC 2015.
   1. Comply with Factory Mutual System Approval Guide to provide FMRC-Approved roof assembly meeting Class IA-90 (FM Standard 4450) requirements for fire resistance and wind uplift in accordance with FM Loss Prevention Data Sheets 1-28 and 1-29. System shall meet uplift pressures in accordance with the IBC 2015, using 130mph base wind speed.
   2. Underwriters Laboratories, Inc. (UL): Class A Fire Hazard Classification.

D. Qualifications:

1. Manufacturer: Company specializing in manufacturing the products specified in this section with 10 years documented experience.

E. 2. Applicator: Company specializing in performing the work of this section with 5 years documented experience. Installer shall be an authorized roofing applicator for the system being installed. Manufacturer is to certify that applicator has 5 years minimum documented experience, and is a certified installer approved to install the manufacturer's 20 year roofing system as specified.

F. Pre-installation Meeting:
1. Convene a Pre-installation Meeting at Project Site one week prior to date scheduled for commencing work of this Section.
2. Require attendance of parties directly affecting work of this Section.
3. Review preparation and installation procedures, and coordinating and scheduling required, with related work.
   a. Require Manufacturer's Roofing Quality Control Inspector to attend and participate in Pre-installation Meeting along with Contractor Quality Control Representative and Architect/Engineer.
4. Agenda:
   a. Tour, inspect and discuss existing conditions, roof drains, roof drain final locations, curbs, penetrations, flashing, and other preparatory work performed by other trades.
   b. Review structural loading limitations of deck, inspect existing pitch to drains, and review conditions for required fastening.
   c. Review of on-site approved shop drawings for field conditions.
   d. Review roofing system requirements (Drawings, Specifications and other Contract Documents).
   e. Review required submittals, both completed and yet to be completed.
   f. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
   g. Review requirements for Manufacturer's Roofing Quality Control Inspector inspections, other inspections, testing, certifying, and material usage accounting procedures.
   h. Review procedures and verify readiness of contractor for coping with unfavorable weather conditions, including the possibility of requiring emergency weather protection.
   i. Review safety precautions relating to roofing installation.
   j. Square foot area phasing and overnight roof seal and protection.
   k. Asbestos abatement coordination.
   l. Debris removal.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code(s) for roof assembly fire hazard requirements.

B. Underwriters Laboratories, Inc. (UL): Class A Fire Hazard Classification.

C. Factory Mutual (FM) 1-90 Compliance / Roof Assembly and 1-49 Loss Prevention Data Sheet.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 016500.

B. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact. Upon observation by Architect and at Architect's direction, remove plastic shipping material.

Materials being stored are to be covered with canvas; poly will not be accepted as a cover material.

C. Store products in weather protected environment, clear of ground and moisture.

D. Protect foam insulation from direct exposure to sunlight, precipitation, and condensation.

E. All curable materials must be stored between 60° F and 80° F.

F. Protect adjacent materials and surfaces against damage from roofing work. Do not store materials on previously completed roofing.

G. All components including underlayment, flashings, and metal edgings must be supplied and warranted by the roof system manufacturer.

H. Do not store roofing materials and other miscellaneous materials in concentration on roof.

1.09 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply roofing membrane during inclement weather or when ambient temperature is expected to fall below 40 degrees F. Follow cold weather application procedures recommended by manufacturer.
   2. Do not apply roofing membrane to wet, damp or frozen deck surface or when precipitation is occurring.
   3. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed in the same day.
   4. Proceed with roofing work when existing & forecasted weather conditions permit work to be performed in accordance with manufacturer's recommendations and warranty requirements.

B. Coordination
   1. 1. Coordinate work under provisions of Section 013100.
   2. Coordinate the work with the installation of associated metal flashings, roof drains and other penetrations, asbestos abatement, and roof demolition.
   3. Coordinate with Owner's operations.

C. Provide covers and other means of protection as necessary to protect building surfaces against damage during roofing work.

D. Protect existing roof surfaces from foot traffic etc. in accord with manufacturer's recommendations. Repair, at contractor's expense, all damage to existing roof system in areas subjected to construction foot traffic, etc.

E. No storage or traffic is to occur outside of the contract limits.

1.10 WARRANTY

A. Contractor's Guarantee
   1. The contractor guarantees that the total roofing installation, together with all related composition flashings, plastic flashings, metal flashings, roof insulation, any vapor seal, cants, blocking, adhesives and seals installed in connection with same, will be watertight and free from defects as to materials, installation, and/or workmanship, for a period of two (2) years from the date approval of the Final Certificate for Payment.
   2. During the 2-year guarantee period, the Contractor agrees that within 24 hours of receipt of notice from the District, he will inspect and make immediate emergency repairs to

defects or to leaks in roof system, and that within a reasonable time, (within days) he will restore the affected items to the standard of the original specifications.

3. All emergency and permanent work during the life of the Contractor's guarantee will be done without cost to the District, except in the event it is determined that such leaks were caused by abuse, lightning, hurricane, tornado, hail storm, other unusual climatic phenomena of the elements, or failure of adjacent or related work previously installed by others.

B. Manufacturers Warranty:
   1. Submit 20 year total roof system written warranty, with no dollar limit (NDL), signed by roofing system manufacturer agreeing to promptly repair leaks in roof membrane and base flashings resulting from defects in materials and workmanship. Peak wind coverage of 90mph measured 10 meters above ground.
   2. Include the following items within Warranty:
      a. Membranes.
      b. Flashings, including metal flashings and accessories supplied by roofing membrane manufacturer.
      c. Insulation.
      d. Vapor barrier and liquid applied waterproofing.
      e. Fasteners, primers and adhesives.
      f. Accessories.
      g. Roofing inspection and written report by Manufacturer's Roofing Quality Control Inspector at date of Final Acceptance.
      h. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
      i. Temporary emergency repairs may be made in accordance with Manufacturer's specifications by the District without voiding any warranty provisions.
   3. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Roofing Specification Section to Warranty.
   4. Install a framed and waterproofed copy of the following items mounted in roof hatchway: Warranty and instructions including system description, repair procedures, installation contractor, warranty information and contact telephone / email addresses.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain components including but not limited to: roof insulation, fasteners, vapor retarder, membrane, adhesives, tapes, flashings, metal edges, copings as applicable and cover board for roofing system from same manufacturer as membrane roofing.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing, base flashing, and edge and coping conditions 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 G 154, or ASTM G 155.
   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. Corner, Perimeter and Field-of-Roof Uplift Pressure:
      a. Field = 40psf
      b. Perimeter = 70psf
      c. Corner = 90psf
      d. Hail-Resistance Rating: 1” Hail Resistance

D. Exterior Fire-Test Exposure: ASTM E 108 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.

2.03 EPDM ROOFING

A. EPDM: ASTM D 4637, Type I, nonreinforced, uniform, flexible EPDM sheet.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Versico Roofing Systems; VersiGARD EPDM or a comparable product by one of the following:
      a. Carlisle Syntec Systems.
      b. Firestone Building Products.
      c. Johns Manville.
      d. Thickness: 60 mils (2.2 mm), nominal.
      e. Exposed Face Color: White.

B. Seaming Materials: As provided by membrane manufacturer.

C. Polyisocyanurate bonded foam surfaced insulation as indicated below. Minimum insulation thickness over the field of each single roof surface shall not be less than 5.2” (R value = 30), within 4’-0” of Roof Drain shall not be less than 4.2”. Required thickness to be achieved using a minimum of two (2) layers of insulation.
   1. ASTM C578, of type and minimum compressive strength indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84, Type IV, 25psi minumum.
   2. Overlayered insulation board applied as a second layer with joints offset from bottom layer.

D. Tapered Insulation: Provide crickets, saddles, and tapered insulation of same material as second layer of insulation; taper to the following slopes:
   1. Crickets and Saddles: 1/2" inch per foot, or as required to provide adequate positive drainage.
   2. Insulation Installed to Counterslope Roof Structure: 1/2" inch per foot, or twice slope of roof.
   3. Insulation over level roof structure: To be fabricated with a taper of 1/8 inch per foot, minimum.

2.04 ACCESSORIES

A. Base Flashings: Flexible sheet flashing, type to suit membrane sheeting and as recommended by the roofing manufacturer.

B. Prefabricated Control or Expansion Joint Flashing: Type approved by roofing manufacturer.

C. Substrate Board: Securock Gypsum Fiber Board 5/8” x 48” x 96”. Fastened with manufacturer supplied fasteners and 3” plates at a rate of one every two square feet in the field. Perimeter and corner enhancements as required per project wind speed requirements

D. Vapor Barrier / Temporary Roof: 725 Air and Vapor Barrier 40-mil composite consisting of 35 mils of self-adhering rubberized asphalt factory laminated to a 5-mil polyethylene film with an adhesive textured surface. 725 TR roll dimensions are 39” x 75’ and the product is applied after priming with 702 LV asphalt primer or Cav-Grip primer

E. Insulation Adhesive: DASH Insulation adhesive shall be used in 4” on-center ribbon patterns to adhere the base layer to the 725 TR, the tapered layers to the base layer and the coverboard to the tapered layer. All layers of boards to be completely staggered. Manufacturer’s installation guidelines to be completely followed.

F. Pressure Sensitive Flashing: 6" wide; self-adhering as recommended by membrane manufacturer.

G. Membrane fastening plates: "RTS" strips and corresponding anchors as recommended by membrane manufacturer.

H. Pitch Pockets: Pourable sealer pockets: Membrane manufacturer's standard. Top pitched to roofing membrane ½” per foot, minimum.

I. Sealants and Primer: As recommended by membrane manufacturer.

J. Membrane Adhesive and anchors: As recommended by membrane manufacturer.

K. Termination Bar: Manufacturer standard.

L. Walkway Pads: As manufactured by membrane manufacturer, to be installed around all rooftop equipment, as indicated on plans. Pads are to be fully adhered to membrane with continuous lap sealant around perimeter.

M. Molded Pipe Flashings inside and outside corner flashing: as recommended by membrane manufacturer.

N. Cover Board: ASTM C 1278/C 1278M, cellulosic-fiber reinforced, water-resistant gypsum substrate, 5/8 inch (16 mm) thick; Basis-of-Design Product: Versico Roofing Systems; Securock Roof Board.

O. Roof Drains - Heavy Duty roof drain with cast aluminum strainer dome with screw down lid, drain bowl, drain receiver and all associated items necessary for a complete new drain system 3’-0” back from roof drain bowl; Manufacturer: Superdome or approved equal.

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 wood blocking, curbs, and nailers are securely anchored to roof deck or structure at penetrations, roof edges and terminations and that nailers match thicknesses of insulation.

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.

C. Install roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.04 BASE SHEET INSTALLATION

A. Clean substrate of any residual debris.

B. Notify architect of any damaged decking.

C. Gypsum Fiber Roof Board (USG Securock or approved equal), 5/8” x 48” x 96”. Fasten with manufacturer recommended fasteners and 3” plates at a rate of one every two square feet.

D. 725 Air and Vapor Barrier is a 40-mil composite consisting of 35 mils if self-adhering rubberized asphalt factory laminated to a 5-mil polyethylene film with an adhesive textured surface. 725 TR roll dimensions are 39” x 75’ and the product is applied after priming with 702 LV asphalt primer or Cav-Grip primer

E. Sweep and blow clean base sheet prior to installation of the insulation and adhesive.

F. Do not install more base sheet than can be covered in a day. All material to be covered with installed assembly.

G. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.05 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. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

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 (6 mm) with insulation.
   1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:
   1. Set each layer of insulation in ribbons of bead-applied 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 (150 mm) in each direction. Loosely butt cover boards together.
   1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

3.06 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll membrane roofing and allow to relax before installing.

B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. 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.

D. Apply roofing with side laps shingled with slope of roof deck where possible.

E. 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. Factory seam tape at 3” wide. Field seam tape at 6” wide.

F. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

G. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal membrane roofing in place with clamping ring.

3.07 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars with water cutoff mastic and continuous bead of sealant at top.

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 PHASING OF WORK

A. Perform work when weather forecast indicates 3-days clear.

B. Perform work at times and in sequences approved by the School District.

C. Perform work in sequence with the approved Phasing Plan.

3.10 FIELD QUALITY CONTROL

A. Section 014500 - Quality Control: Field inspection.

B. Manufacturer's Field Services: Manufacturer's Roofing Quality Control Inspector.
   1. Attend and participate in Pre-installation Meeting.
   2. Perform preparatory, initial, follow-up and final inspections for roof insulation and roofing system.
   3. Prepare and submit inspection and acceptance reports every two weeks, for each inspection made, to the Architect.

C. Upon completion of the installation a manufacture's technical representative must conduct an on site inspection in the presence of the Architect/Engineer to insure that the installation has been installed in accordance with the manufacturers specifications.

D. Protect interior spaces and individuals beneath work from water and construction debris during project.

E. Provide and coordinate flood testing.

F. Correct identified defects and irregularities.

3.11 CLEANING

A. Section 017423 - Part 3 - Execution: Requirements for cleaning.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturers of surfaces for cleaning advice and conform to their instructions.

C. Repair or replace defaced or disfigured finishes caused by work of this section.

3.12 PROTECTION

A. Protect finished work under provisions of Section 015000.

B. Protect building surfaces against damage from roofing work.

C. Where, by necessity, work shall continue over finished roof membrane, protect surfaces. Stage work in such a manner so that areas most remote from the staging area are completed first to prevent, to the maximum extent possible, work or traffic over previously re-roofed areas.

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. Formed roof-drainage sheet metal fabrications.
   2. Copings and splice plates.
   3. Drip edges.
   4. Base and Counter flashing.
   5. Through Wall 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 B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B32 - Standard Specification for Solder Metal; 2020.

C. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

D. 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: 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 1-180 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. 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 minimum or 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.
      b. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.

c. Color: as selected by the Architect from the maunfacturer's full range of color offerings.

3. Color: as selected by the Architect from the maunfacturer'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 materials:
   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.
   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 079200 - JOINT SEALANTS.

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 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 A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

E. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

F. ASTM B32 - Standard Specification for Solder Metal; 2020.

G. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. Submit under provisions of Section 013300 - SHEET METAL WORK.

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 - NON-PENETRATING ROOFTOP SUPPORT SYSTEMS.

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 - OVERHEAD COILING DOORS.

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) 0.040" 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, 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. Primer: Zinc chromate type.

I. 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.

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.

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. Roof curbs.
   2. Equipment supports.
   3. Roof hatches.
   4. Pipe supports.

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 - SUBMITTALS, for Submittal Procedures.

B. LEED Data Submissions: See Section 018113 - SUSTAINABILITY DESIGN REQUIREMENTS.

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, 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 ROOF HATCH

A. Roof Hatches: Thermally broken metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

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)
   b. Acudor Products, Inc.
   c. Babcock-Davis

B. Model (Size): E-50TB (36 inches x 36 inches)

C. Type: Single-leaf lid, Thermally Broken.

D. Loads: Minimum 40-lbf/sq. ft. external live load and 25-lbf/sq. ft. internal uplift load.

E. Hatch Material: Aluminum sheet, 0.090 inch (2.28 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, 3" thick with an R-value of 20.3 (U=0.049) with an 18 gauge aluminum liner.
   2. Cover: Thermally broken, insulated, and double walled, with 11 gauge aluminum liner of same finish as outer metal lid. Cover shall have a heavy extruded EPDM rubber gasket bonded to the cover interior providing a continuous seal with the top of the curb.
   3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb. The curb shall be formed with a 5 1/2" flange with 7/16" 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. Lifting Mechanism: Compression spring operators enclosed in telescopic tubes controlling the operation of the Cover throughout the entire movement of the cover. Tubes shall be located to prevent accumulation of moisture, dirt and debris. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

G. Hardware: Heavy stainless-steel spring latch with interior and exterior turn handles, pintle-type hinge system, 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.

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 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. Roof-Hatch Installation:
   1. Install roof hatch so top surface of hatch curb is level.
   2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
   3. Attach safety railing system to roof-hatch curb.
   4. Attach ladder-assist post according to manufacturer's written instructions.

F. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.

G. Seal joints with butyl sealant as required by roof accessory manufacturer.

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

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

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 mastic and intumescent fire-resistive coatings (MIFRC).

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Product Certificates: For each type of fireproofing.

C. UL Design Assembly number including selected products as indicated on the drawings.

D. Evaluation Reports: For fireproofing, from ICC-ES.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F (10 deg C) 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 fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fireproofing for each fire-resistance design 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
   1. Flat Paints and Coatings: 50 g/L.
   2. Non-flat Paints and Coatings: 150 g/L.
   3. Primers, Sealers, and Under-coaters: 200 g/L.
   4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   5. Fireproofing Exterior Coatings: 350 g/L.

E. Asbestos: Provide products containing no detectable asbestos.

2.02 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. MIFRC: Manufacturer's standard, factory-mixed formulation or factory-mixed, multicomponent system consisting of intumescent primer, base coat and topcoat, and complying with indicated fire-resistance design.
   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. Albi Manufacturing, Division of StanChem Inc.; Albi Clad 800.
      b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Thermo-Lag 3000-SP.
      c. Isolatek International; Cafco Spray Film-WB 4.
   2. Application: Designated for "exterior" "interior general purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
   3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
   4. 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: 15 or less.
      b. Smoke-Developed Index: 50 or less.
   5. Hardness: Not less than 80, Type D durometer, according to ASTM D2240.
   6. Finish color: As selected by Architect from manufacturer's standard finishes.
      a. Texture and Gloss: As indicated by manufacturer's designations for items concealed by construction. Smooth and Gloss for items left exposed.

2.03 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing 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 fireproofing with substrates under conditions of normal use or fire exposure.
   2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
   3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.

B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. 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 fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing.

C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

E. Coordinate application with construction schedule to coat and allow curing of items requiring Intumescent coating prior to installation(s).

3.03 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
   1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
   2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.

E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

F. Extend fireproofing in full thickness over entire area of each substrate to be protected.

G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.

I. Cure fireproofing according to fireproofing manufacturer's written recommendations.

J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fireproofing to produce the following finishes:
   1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

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.

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fireproofing will be considered defective if it does not pass tests and inspections.
   1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
   2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

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. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.

C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.

D. Repair fireproofing damaged by other work before concealing it with other construction.

E. Repair fireproofing by reapplying it using same method as original installation or using manufacturers recommended trowel-applied product.

END OF SECTION

PART 1 - GENERAL

1.01 **SECTION INCLUDES**

A. Provide through penetration firestopping. The work of this section shall include, but not be limited to, the following:
   1. Provide firestopping at all openings in floors and fire rated walls and partitions to prevent the passage of fire, smoke or toxic gases and to maintain required fire ratings.
   2. Provide firestopping at all electrical, plumbing and electrical duct and pipe penetrations in floors, and fire-rated walls and partitions, to prevent the passage of fire, smoke or toxic gases.

1.02 **QUALITY ASSURANCE**

A. Qualifications: The work of this section shall be performed by a qualified and experienced installer, acceptable to the Architect/Engineer. The term "installer", as used herein shall mean a firm of established reputation; which has been trained by the manufacturer in the proper installation of fire safing material and which is regularly engaged in, and maintains a regular force of workers skilled in the installation of fire safing material of the type specified.

1.03 **REFERENCES**

A. Codes and Regulations: Comply with applicable regulations of governmental authorities having jurisdiction.

B. ASTM E119, Method for Fire Tests of Building Construction and Materials.

C. ASTM E814, Fire Tests of Through Penetration.

D. U.L. 1479, Standards for Fire Tests of Through Penetration Firestops.

E. Factory Mutual Systems.

1.04 **SUBMITTALS**

A. Shop Drawings: Shop drawings shall indicate the locations and types of the various fire safing material to be used throughout the building, and material and methods of installation of damming for the various floor, wall and ceiling construction. Details of damming shall be large scale and shall indicate material and methods of installation.

B. Product Data: Submit manufacturer's technical data and installation instructions.

C. Test Reports: Submit copies of test reports, by an independent testing laboratory, indicating that the fire safing material complies with the specified requirements.

1.05 **FIELD QUALITY CONTROL**

A. Section 014500 - Quality Control: field inspection and testing.

B. Tests for thickness and density of applied material will be performed by an independent testing agency. Where test results are unsatisfactory in sample areas, additional tests in other areas may be made. Such further testing, if required, shall be by the same testing agency but shall be paid for by the installer.

C. Independent Testing Agency will:

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 certification to the Architect, indicating installation meets or exceeds requirements of contract documents.

1.06 **WARRANTY**

A. Provide standard manufacturer's warranty on material composition and resistance to breakdown.

PART 2 - PRODUCTS

2.01 **FIRE RESISTANT SILICONE FOAM**

A. Acceptable materials are DOW CORNING Silicone RTV Foam, Chase-Foam CTCPR-855 by CHASE TECHNOLOGY CORP., Pensil RTV 851 by GENERAL ELECTRIC, or approved equal.

B. Foam sealant shall conform to the required fire rating in accordance with the requirements of ASTM E119, with a flamespread rating of 15 in accordance with ASTM E84. Foam sealant shall also conform to UL Standard 1479: "Standards for Fire Tests of Through Penetration Firestops".

C. The foam sealant shall provide a fire resistance equal to the construction into which it is installed; in accordance with "Through Penetration Firestop Systems (XHEZ)" in the Underwriters Laboratories "Building Materials Directory".

D. Dams: Provide dams as recommended by the manufacturer, as required for proper installation and for required fire rating.

2.02 **MINERAL FIBER FIRE SAFING INSULATION**

A. 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.

B. Provide 20 gauge minimum metal plate where required for fire safing support to comply with fire ratings.

C. Do not use fibrous safing insulation unless it is in conjunction with a compatible smoke seal as specified herein.

2.03 **MINERAL WOOL**

A. 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 **FIRESTOPPING SEALANT**

A. Provide a silicone firestop sealant classified for both flame and temperature ratings under ASTM E814.

B. Acceptable materials are USG INTERIORS "Smoke Seal Compound", DOW CORNING "Firestop Sealant", BIO FIRESHIELD "Biotherm", 3M "Fire-Barrier Caulk", GENERAL ELECTRIC "RTV 7403" or approved equal.

2.05 **FIRESTOPPING MORTAR**

A. Provide Portland cement/fly ash mortar with an air dried density of 50 to 55 pounds per cu.ft. Mortar shall be classified for both flame and temperature ratings under ASTM E814.

B. Acceptable materials are BIO FIRESHIELD "Novasit K-10" or approved equal.

2.06 **PREFORMED PIPE SEALS**

A. Provide preformed intumescent collars classified for both flame and temperature under ASTM E814.

B. Acceptable materials are BIO FIRESHIELD "Firestop Collars", 3M "Wrap/Strip FS 195" or approved equal.

2.07 **ACCESSORIES**

A. Provide anchorage assemblies complying with U.L. designs and other components and accessories as needed.

PART 3 - EXECUTION

3.01 **DELIVERY AND STORAGE**

A. Deliver material and products in unopened packages and containers, clearly indicating name of manufacturer and U.L. labeling. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage. Protect material from freezing or overheating in accordance with manufacturer's instructions.

3.02 **INSPECTION**

A. Examine all surfaces to which the firestopping materials are to be applied, and notify the Architect/Engineer in writing of any conditions detrimental to the proper and expeditious installation of the work. Starting of work within an area shall be construed as acceptance of the conditions of that area.

B. Thoroughly clean all surfaces to receive firestopping material to eliminate mill scale, dirt, grime, oil, grease, dust, loose rust or paint, and all other foreign material.

C. Cleaning shall be accomplished just prior to application of firestopping material.

3.03 **INSTALLATION (GENERAL)**

A. Material and equipment shall be as approved by the manufacturer. Application procedures shall be in strict accordance with the manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the material manufacturer shall be allowed to place the material.

B. Provide firestopping material at thicknesses as required to provide indicated ratings. Where not otherwise indicated, comply with U.L. standard designs. In multiple layer work, offset joints by at least 6 inches.

C. Anchor firestopping using manufacturer's recommended system and in compliance with U.L. standard designs.

D. Install firestopping without gaps and voids of any kind. Do not use damaged materials. Remove and replace nonfitting or disturbed work.

3.04 **MINERAL SAFING INSULATION**

A. Use mineral safing insulation at top of fire-rated partitions at underside of metal deck to provide complete fire-rated seal.

B. Mineral safing insulation must be used in conjunction with a sealant or foam firestop to ensure a continuous smoke seal.

3.05 **FIRESTOPPING SEALANT**

A. Use firestopping sealant at narrow joints at fire-rated floor and wall penetrations, and at penetrations subject to vibration or movement. Typical penetrations requiring sealant are plumbing and HVAC piping, electric conduit and ductwork.

B. Where openings are large enough, use mineral safing insulation in thicknesses required to dam the joint, and apply 1/2 inch minimum depth of sealant, or as required to achieve the rated assembly.

3.06 **FOAM-IN-PLACE FIRESTOPPING**

A. Apply foam-in-place firestopping material in depths required to meet the fire ratings indicated or required by U.L. standards. Provide clips or other approved means to contain the foam-in-place material which will enable the foam to solidly fill the areas intended. Mixing and application shall be in strict accordance with the manufacturer's written instructions.

B. Foam firestopping may be used in lieu of sealant or mortar material at the Contractor's option, provided details conform to manufacturer's recommendations for maintaining the integrity of the assembly in question.

3.07 **FIRESTOPPING MORTAR**

A. Mortar may be used to firestop all large, nonmoving openings in fire-rated assemblies, including multiple openings in floor slabs.

B. Mix mortar with clean water in accordance with the manufacturer's printed instructions. Wet all surfaces with water prior to application of mortar. Apply by hand or pump and vibrate in penetrations to prevent voids from forming.

C. Do not apply mortar if ambient or substrate temperature is below 35°F during the 24 hour period before application.

3.08 **PREFORMED PIPE SEALS**

A. Use preformed pipe seals for firestopping nonmetallic pipes or conduit penetrating rated assemblies. Preformed collars may be surface mounted or embedded in firestop mortar as space permits to seal PVC or ABS pipe penetrations. Size selection and installation shall be in strict accordance with manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL

A. Coordinate installation of firestopping work with other work to minimize cutting and removal of installed firestopping. As work of other trades is completed, review firestopping work and repair or replace work which has been damaged or removed. Inspections will be performed to verify compliance with requirements.

3.10 CLEANING AND PROTECTION

A. Upon completion of the work, remove all unused materials from the site. Clean floors, walls and other adjacent surfaces that are stained, marred or otherwise damaged by this work. Leave all work and the adjacent areas in a clean condition.

B. Protect all completed work from damage, by methods recommended by the manufacturer of installed material.

3.11 SYSTEMS AND APPLICATION SCHEDULE

	CONSTRUCTION CONDITION	UL DESIGNATION
B.	Metal Pipe or Conduit	220, 221, 223
	1. Through Round Opening	316, 400, 425
C.	Insulated Metal Pipe	301, 310, 402, 403
	1. Through Round Opening	
D.	Metal Pipes or Conduits	399
	1. Through Large Openings	
E.	Cables Through Opening	222, 224, 307, 425
F.	Nonmetallic (Plastic) Pipe	300
	1. or Conduit through Opening	
G.	Metal Pipe or Conduit	425
	1. Through Gypsum Board Wall	
H.	Nonmetallic (Plastic) Pipe	226, 227, 228, 312
	1. or Conduit Through Gypsum	
	2. Board Wall	
I.	Cables Through Gypsum	425
	1. Board Wall	
J.	Mixed Penetrating Items	218, 219
K.	1. Ductwork Insulated	301
	1. Through Gypsum Board Wall in	227, 313
	2. Sleeve Opening	
L.	1. Ductwork	218, 219
	1. 2 Hr Gypsum Wall	312

3.12 PROVIDE ADDITIONAL UL DESIGNATION AS REQUIRED TO ACHIEVE FIRESTOPPING RATINGS EQUAL TO OR GREATER THAN ASSEMBLY PENETRATION.

END OF SECTION

PART 1 - GENERAL

1.01 **SECTION INCLUDES**

A. Provide through penetration firestopping. The work of this section shall include, but not be limited to, the following:
   1. Provide firestopping at all openings in floors and fire rated walls and partitions to prevent the passage of fire, smoke or toxic gases and to maintain required fire ratings.
   2. Provide firestopping at all electrical, plumbing and electrical duct and pipe penetrations in floors, and fire-rated walls and partitions, to prevent the passage of fire, smoke or toxic gases.

1.02 **QUALITY ASSURANCE**

A. Qualifications: The work of this section shall be performed by a qualified and experienced installer, acceptable to the Architect/Engineer. The term "installer", as used herein shall mean a firm of established reputation; which has been trained by the manufacturer in the proper installation of fire safing material and which is regularly engaged in, and maintains a regular force of workers skilled in the installation of fire safing material of the type specified.

1.03 **REFERENCES**

A. Codes and Regulations: Comply with applicable regulations of governmental authorities having jurisdiction.

B. ASTM E119, Method for Fire Tests of Building Construction and Materials.

C. ASTM E814, Fire Tests of Through Penetration.

D. U.L. 1479, Standards for Fire Tests of Through Penetration Firestops.

E. Factory Mutual Systems.

1.04 **SUBMITTALS**

A. Shop Drawings: Shop drawings shall indicate the locations and types of the various fire safing material to be used throughout the building, and material and methods of installation of damming for the various floor, wall and ceiling construction. Details of damming shall be large scale and shall indicate material and methods of installation.

B. Product Data: Submit manufacturer's technical data and installation instructions.

C. Test Reports: Submit copies of test reports, by an independent testing laboratory, indicating that the fire safing material complies with the specified requirements.

1.05 **FIELD QUALITY CONTROL**

A. Section 014500 - Quality Control: field inspection and testing.

B. Tests for thickness and density of applied material will be performed by an independent testing agency. Where test results are unsatisfactory in sample areas, additional tests in other areas may be made. Such further testing, if required, shall be by the same testing agency but shall be paid for by the installer.

C. Independent Testing Agency will:

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 certification to the Architect, indicating installation meets or exceeds requirements of contract documents.

1.06 **WARRANTY**

A. Provide standard manufacturer's warranty on material composition and resistance to breakdown.

PART 2 - PRODUCTS

2.01 **FIRE RESISTANT SILICONE FOAM**

A. Acceptable materials are DOW CORNING Silicone RTV Foam, Chase-Foam CTCPR-855 by CHASE TECHNOLOGY CORP., Pensil RTV 851 by GENERAL ELECTRIC, or approved equal.

B. Foam sealant shall conform to the required fire rating in accordance with the requirements of ASTM E119, with a flamespread rating of 15 in accordance with ASTM E84. Foam sealant shall also conform to UL Standard 1479: "Standards for Fire Tests of Through Penetration Firestops".

C. The foam sealant shall provide a fire resistance equal to the construction into which it is installed; in accordance with "Through Penetration Firestop Systems (XHEZ)" in the Underwriters Laboratories "Building Materials Directory".

D. Dams: Provide dams as recommended by the manufacturer, as required for proper installation and for required fire rating.

2.02 **MINERAL FIBER FIRE SAFING INSULATION**

A. 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.

B. Provide 20 gauge minimum metal plate where required for fire safing support to comply with fire ratings.

C. Do not use fibrous safing insulation unless it is in conjunction with a compatible smoke seal as specified herein.

2.03 **MINERAL WOOL**

A. 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 **FIRESTOPPING SEALANT**

A. Provide a silicone firestop sealant classified for both flame and temperature ratings under ASTM E814.

B. Acceptable materials are USG INTERIORS "Smoke Seal Compound", DOW CORNING "Firestop Sealant", BIO FIRESHIELD "Biotherm", 3M "Fire-Barrier Caulk", GENERAL ELECTRIC "RTV 7403" or approved equal.

2.05 **FIRESTOPPING MORTAR**

A. Provide Portland cement/fly ash mortar with an air dried density of 50 to 55 pounds per cu.ft. Mortar shall be classified for both flame and temperature ratings under ASTM E814.

B. Acceptable materials are BIO FIRESHIELD "Novasit K-10" or approved equal.

2.06 **PREFORMED PIPE SEALS**

A. Provide preformed intumescent collars classified for both flame and temperature under ASTM E814.

B. Acceptable materials are BIO FIRESHIELD "Firestop Collars", 3M "Wrap/Strip FS 195" or approved equal.

2.07 **ACCESSORIES**

A. Provide anchorage assemblies complying with U.L. designs and other components and accessories as needed.

PART 3 - EXECUTION

3.01 **DELIVERY AND STORAGE**

A. Deliver material and products in unopened packages and containers, clearly indicating name of manufacturer and U.L. labeling. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage. Protect material from freezing or overheating in accordance with manufacturer's instructions.

3.02 **INSPECTION**

A. Examine all surfaces to which the firestopping materials are to be applied, and notify the Architect/Engineer in writing of any conditions detrimental to the proper and expeditious installation of the work. Starting of work within an area shall be construed as acceptance of the conditions of that area.

B. Thoroughly clean all surfaces to receive firestopping material to eliminate mill scale, dirt, grime, oil, grease, dust, loose rust or paint, and all other foreign material.

C. Cleaning shall be accomplished just prior to application of firestopping material.

3.03 **INSTALLATION (GENERAL)**

A. Material and equipment shall be as approved by the manufacturer. Application procedures shall be in strict accordance with the manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the material manufacturer shall be allowed to place the material.

B. Provide firestopping material at thicknesses as required to provide indicated ratings. Where not otherwise indicated, comply with U.L. standard designs. In multiple layer work, offset joints by at least 6 inches.

C. Anchor firestopping using manufacturer's recommended system and in compliance with U.L. standard designs.

D. Install firestopping without gaps and voids of any kind. Do not use damaged materials. Remove and replace nonfitting or disturbed work.

3.04 **MINERAL SAFING INSULATION**

A. Use mineral safing insulation at top of fire-rated partitions at underside of metal deck to provide complete fire-rated seal.

B. Mineral safing insulation must be used in conjunction with a sealant or foam firestop to ensure a continuous smoke seal.

3.05 **FIRESTOPPING SEALANT**

A. Use firestopping sealant at narrow joints at fire-rated floor and wall penetrations, and at penetrations subject to vibration or movement. Typical penetrations requiring sealant are plumbing and HVAC piping, electric conduit and ductwork.

B. Where openings are large enough, use mineral safing insulation in thicknesses required to dam the joint, and apply 1/2 inch minimum depth of sealant, or as required to achieve the rated assembly.

3.06 **FOAM-IN-PLACE FIRESTOPPING**

A. Apply foam-in-place firestopping material in depths required to meet the fire ratings indicated or required by U.L. standards. Provide clips or other approved means to contain the foam-in-place material which will enable the foam to solidly fill the areas intended. Mixing and application shall be in strict accordance with the manufacturer's written instructions.

B. Foam firestopping may be used in lieu of sealant or mortar material at the Contractor's option, provided details conform to manufacturer's recommendations for maintaining the integrity of the assembly in question.

3.07 **FIRESTOPPING MORTAR**

A. Mortar may be used to firestop all large, nonmoving openings in fire-rated assemblies, including multiple openings in floor slabs.

B. Mix mortar with clean water in accordance with the manufacturer's printed instructions. Wet all surfaces with water prior to application of mortar. Apply by hand or pump and vibrate in penetrations to prevent voids from forming.

C. Do not apply mortar if ambient or substrate temperature is below 35°F during the 24 hour period before application.

3.08 **PREFORMED PIPE SEALS**

A. Use preformed pipe seals for firestopping nonmetallic pipes or conduit penetrating rated assemblies. Preformed collars may be surface mounted or embedded in firestop mortar as space permits to seal PVC or ABS pipe penetrations. Size selection and installation shall be in strict accordance with manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL

A. Coordinate installation of firestopping work with other work to minimize cutting and removal of installed firestopping. As work of other trades is completed, review firestopping work and repair or replace work which has been damaged or removed. Inspections will be performed to verify compliance with requirements.

3.10 CLEANING AND PROTECTION

A. Upon completion of the work, remove all unused materials from the site. Clean floors, walls and other adjacent surfaces that are stained, marred or otherwise damaged by this work. Leave all work and the adjacent areas in a clean condition.

B. Protect all completed work from damage, by methods recommended by the manufacturer of installed material.

3.11 SYSTEMS AND APPLICATION SCHEDULE

	CONSTRUCTION CONDITION	UL DESIGNATION
B.	Metal Pipe or Conduit	220, 221, 223
	1. Through Round Opening	316, 400, 425
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	1. Through Round Opening	
D.	Metal Pipes or Conduits	399
	1. Through Large Openings	
E.	Cables Through Opening	222, 224, 307, 425
F.	Nonmetallic (Plastic) Pipe	300
	1. or Conduit through Opening	
G.	Metal Pipe or Conduit	425
	1. Through Gypsum Board Wall	
H.	Nonmetallic (Plastic) Pipe	226, 227, 228, 312
	1. or Conduit Through Gypsum	
	2. Board Wall	
I.	Cables Through Gypsum	425
	1. Board Wall	
J.	Mixed Penetrating Items	218, 219
K.	1. Ductwork Insulated	301
	1. Through Gypsum Board Wall in	227, 313
	2. Sleeve Opening	
L.	1. Ductwork	218, 219
	1. 2 Hr Gypsum Wall	312

3.12 PROVIDE ADDITIONAL UL DESIGNATION AS REQUIRED TO ACHIEVE FIRESTOPPING RATINGS EQUAL TO OR GREATER THAN ASSEMBLY PENETRATION.

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. 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

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" wide by 6" 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-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 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 C 1247. 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 Material)
1. M = Mortar Contact
2. G = Glass Contact
3. A = Aluminum Contact
4. O = Other Materials

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, 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

E. Floor-to-Wall:
1. Basis-of-Design Product: Inpro.
2. Type: Recessed Mount Seismic Floor Cover, ASTM E1399
3. Model: 223 Series - A02 Floor to Wall
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

F. Wall-to-Wall:
1. Basis-of-Design Product: Construction Specialties
2. Type: FLUSH THINLINE.
3. Model: FWF
4. Design Criteria:
    a. Nominal Joint Width: As indicated on Drawings.
    b. Type of Movement: Thermal.
5. Type: Cover plate.
    a. Metal: Aluminum.
        1) Finish: Clear anodic, Class II Manufacturer's standard.

G. Wall-to-Ceiling:
1. Basis-of-Design Product: Construction Specialties.
2. Type: FLUSH THINLINE.
3. Model: FCFC
4. Design Criteria:
    a. Nominal Joint Width: As indicated on Drawings.
    b. Type of Movement: Thermal.
5. Type: Cover plate.
    a. Metal: Aluminum.
        1) Finish: Clear anodic, Class II Manufacturer's standard.
    b. Seal Material: Manufacturer's standard.
        1) Color: As selected by Architect from manufacturer's full range.

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

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 hollow-metal doors, fixed panels and frames.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.04 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:
   1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.
   2. For "Doors" and "Frames" subparagraphs below, prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.06 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Ceco Door Products; an Assa Abloy Group company.
   2. Curries Company; an Assa Abloy Group company.
   3. Karpen Steel Custom Doors & Frames.
   4. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.03 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra Heavy-Duty Doors and Frames: SDI A250.8 - Level 3. At locations indicated in the Door and Frame Schedule.
   1. Physical Performance: Level B according to ANSI/SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1 3/4 inches.
      c. Face: cold-rolled steel sheet, minimum thickness of 0.053 inch (16 gauge) (Level 3).
      d. Edge Construction: Model 2, Seamless.

e. Core Materials: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

3. Frames:
   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (16 gauge) (Level 3).
   b. Construction: Face-welded Type.
4. Exposed Finish: Prime.

2.04 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra Heavy-Duty Doors and Frames: SDI A250.8 - Level 3. At locations indicated in the Door and Frame Schedule.
   1. Physical Performance: Level A according to SDI A250.4.
   2. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1 3/4 inches.
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (16 gauge) (Level 3), with minimum A60 coating.
      d. Edge Construction: Model 2, Seamless.
      e. Core Materials:
         1) Thermal-Rated Doors: Provide doors fabricated with a thermal-resistance value (R-value) of not less than R-10 when tested according to ASTM C1363. Provide Polyisocyanurate insulation.
         2) Provide Proprietary Bullet-resistant Core for doors noted as Security Doors on the drawings.
            (a) Manufacturer: Total Security Solutions or approved equal.
            (b) Security Level: Level 3 in accordance with UL 752.
            (c) Hinges: Continuous Geared Hinge provided from factory.
   3. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (14 gauge) (Level 4), with minimum A60 (ZF120) coating.
      b. Construction: Full Profile Weld Type.
   4. Exposed Finish: Prime.

2.05 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.06 MATERIALS

A. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

C. Frame Anchors: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M, hot-dip galvanized according to ASTM A153/A153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. Grout: ASTM C476, except with a maximum slump of 4 inches, as measured according to ASTM C143/C143M.

F. Glazing: Comply with requirements in Section 088000 - CONCRETE UNIT MASONRY

G. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.07 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:
   1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
   2. Fire Door Cores: As required to provide fire-protection ratings indicated.
   3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
   4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
   5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
   6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
8. Terminated Stops: Terminate stops 6 inches above finish floor with a 45 degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI/SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Frame Moldings: Provide beveled stops and frame moldings around glazed lites and louvers where indicated. Form corners of interior stops and moldings with mitered hairline joints. Exterior frame moldings shall be welded and ground smooth prior to priming.
1. Single Glazed Lites: Provide beveled fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide beveled fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide beveled fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Frame profiles shall be beveled unless indicated otherwise on the drawings.

5. Provide beveled loose stops and moldings on inside of hollow-metal work.
6. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.08 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.09 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable stops located on secure side of opening.

d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that will be filled with grout containing anti-freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:
   a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
   c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
   d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 - CONCRETE UNIT MASONRY and with hollow-metal manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section including the following.
   1. Flush steel door jamb systems of the following types:
      a. Adjustable split-jamb door frames. (EzyJamb Classic Adjust- EZC)
      b. Single rabbet door frames. (EzyJamb Single Rabbet - SRC)
      c. In-swing door frames. (EzyJamb Inswing - ISD)
      d. Flush-finish accessory products:
         1) Wall end caps. (EzyCap)
         2) Wall reveals. (EzyReveal)
         3) Recessed window reveals. (EzyPelmet)
         4) Drywall partition caps. (FastCap)
         5) Architectural door hardware. (Rocyork)
         6) Wallbase skirting. (Alubase)
         7) Flush finish pocket door system. (SlideSet)
         8) Flush finish pocket door trim. (CavKit)

1.02 SU SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each product specified.

B. Shop Drawings: Submit shop drawings showing details of each opening, including elevations, frame profiles, accessories and attachment.

C. Schedule: Submit a door frame schedule indicating number and location of each frame, matching door numbering on the Drawings.

D. Sustainable Design: Submit manufacturer's documentation indicating percentage of recycled steel in frames.

1.03 QUALITY ASSURANCE

A. Manufacturing: Product manufactured under both ISO9001 and ISO14001 - 2015 EMS policy.

B. Source Limitations: Obtain metal frames through one source from a single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Storage and Handling: Comply with manufacturer's recommendations for storage and handling. Protect from weather damage.

1.05 WARRANTY

A. Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design Manufacturer: EzyJamb, 1700 Boulter Industrial Pkwy, Webster, NY 14850. Toll Free: 888- 399-5262. Fax: 585-545-3010. Web: www.ezyjamb.com.

B. Architect approved equivalent.

2.02 TRIMLESS IN INTERIOR DOOR FRAMES

A. Single Rabbet Door Frames: EzyJamb Single Rabbet - SRC complying with the following.
   1. Material: 18 gauge galvannealed steel, one-piece with perforated flanges.
   2. Depth: Suitable for 1 3/4 inch thick doors and applicable partition thicknesses indicated on the drawings.
   3. Fire Rating for 1-3/4 Inch Thick Doors (Intertek listed): 45, 60, and 90 minutes as indicated on the drawings.
   4. Hardware:
      a. Invisible Door Hinges: RocYork RY80-F (Fire-Rated Doors).
      b. Door Strikes: ASA Strike 4-7/8 inches.

2.03 FLUSH-FINISH ACCESSORY PRODUCTS

A. Wall End Caps: EzyCap by EzyJamb, manufactured from 20 gauge cold rolled steel with perforated flanges, size as applicable to wall configuration.

B. Drywall Partition Caps: FastCap by EZY Jamb, manufactured from 20 gauge cold rolled steel with perforated flanges, size as applicable to wall configuration.

C. Architectural Door Hardware:
   1. Door handles: Standard Blank Trim
   2. Door locks: N/A
   3. Door hinges: RocYork RY80-F (Fire-Rated Doors)
   4. Door closer: RocYok RYCC60950
   5. Door strikes: ASA Strike 4-7/8 inches
   6. Door Closers: Concealed Slide Arm Closer-RYCC6950
   7. Door Exit Device: Von Duprin 98/99 Series, Exit Only (EO) US26D, 45 min.
   8. UL Certification - Fire rating: Series Rocyork RY-80, RY-120 and Series Rocyork RY-45 and RY-50. Aluminum 3-Axis adjustable concealed door hinges (for use on swinging type wood fire doors mounted in wood or steel frames), rated up to and including 1/3 hr (20 minutes). Evaluated in accordance with Standard UL 10C.

D. Wallbase Skirting: Alubase by EzyJamb, SK 100-36,100 mm (3.9 inches) x 1.6 mm, flat clear anodized aluminum skirting.

E. FABRICATION
   1. Fabricate frames and accessories accurately, with true lines and profiles.
   2. Fabricate frames to receive specified hardware.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install trimless door frames in accordance with manufacturer's instructions and approved submittals including the following:
   1. Install frames plumb and square.
   2. Use door as a template when available to ensure proper alignment and clearances.
   3. Install frames securely using fasteners suitable for substrate.
   4. Leave frames ready for taping and application of drywall compound.
   5. Repair frames damaged during installation.
   6. Replace frames which cannot be successfully repaired.

B. Install accessory products in accordance with manufacturer's instructions and approved submittals including the following:
   1. Install products plumb and square.
   2. Install products in proper relationship to adjacent construction.
   3. Repair products damaged during installation.
   4. Replace products which cannot be successfully repaired.

3.03 CLEANING AND PROTECTION

A. Clean frames as recommended by manufacturer. Protect from damage until acceptance.

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. Sound Control Doors (STC).
   3. Factory finishing flush wood doors.
   4. Factory fitting flush wood doors to frames and factory machining for hardware.
   5. Louvers installed in flush wood doors.
   6. 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. Louver blade and frame sections, 6 inches long, for each material and finish specified.
   3. 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 - (FFWD)
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: Select White Maple.
   3. Cut: Rift Cut.
   4. Match between Veneer Leaves: Slip 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 LoPro-STC Sound Rated Metal Vision Frame..
   2. or approved equal.

D. Wood Louvers: Door manufacturer's standard solid-wood louvers unless otherwise indicated.
   1. Wood Species: Same species as door faces.

E. Metal Louvers: Roll formed galvanized steel with overlapping frame; finish same as door components; factory-installed.
   1. Fire-Rated Door Louvers: UL (DIR) or ITS (DIR) listed fusible link louver, same rating as door.
      a. Style: Sightproof inverted Y blade.
      b. Louver Free Area: 50% percent.
      c. Fasteners: Exposed, tamper proof fasteners.
      d. Finish: factory finish as selected by the Architect from the manufacturer's full color offering.
      e. Manufacturer:
         1) Rockwood LV-FL.
         2) Air Louvers, Inc
         3) Anemostat; a Mestek company
         4) Architect approved equivalent.
      f. Substitutions: See Section 016100 - Product Requirements and Section 012500 - Subtitution Procedures.

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 - CONCRETE UNIT MASONRY.
   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 - PRE-APPLIED SHEET MEMBRANE WATERPROOFING.

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

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 D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems; 2020.

J. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging; 2020.

K. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

L. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).

M. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

N. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

O. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.

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; 2014.

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.

AB. 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 - SHEET METAL WORK, 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 - FIBER CEMENT SIDING (HARDIE), 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: (FRP-ED)
   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. Access doors and frames for walls and ceilings.
   2. 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 A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

E. NFPA 288 - Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal Fire Resistance-Rated Assemblies; 2022.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

G. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Section 013300 - SHEET METAL WORK: 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. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
   3. Karp Associates, Inc.
   4. Milcor Inc.
   5. 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: C

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. 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. 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.

G. 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

H. 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.

I. 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.

J. 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.

K. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 77 frame and 71 glass (Low E) when tested according to AAMA 1503.

L. 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.

M. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:

1. Sound Transmission Class (STC): Minimum 36 STC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E413.
2. Outdoor-Indoor Transmission Class (OITC): Minimum 30 OITC when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.

N. 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.

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.

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: Trifab Versaglaze 601UT Thermal Framing System (Basis of Design)
      a. System Dimensions: 2 inches x 6 inches (601UT).
      b. Glass: Front Plane
   2. YKK AP America Inc.
   3. EFCO Corporation.
   4. TRACO.

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 FRAMING SYSTEMS

A. 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.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. 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.

D. 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.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, non-bleeding flashing compatible with adjacent materials.

F. 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 (AA 250/425) 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: 350 Medium Stile; 3 1/2 vertical face dimension.
      a. Top Rail: 3 1/2 (350).
      b. Bottom Rail: 10 inch (optional - 350)
         1) Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
   3. Thermally Broken entrance Framing - Kawneer IsoLock™ Thermal Break with a 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.
      a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.
   4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops, 0.05" (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.
   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 - INSTRUMENTATION AND CONTROL INTEGRATION.
   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 - METAL BUILDING SYSTEMS.

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. Kawneer Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating. Color: As selected by the Architect from the manufacturer's full color offering to match existing building aluminum storefront and window framing.

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.
   1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
   2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

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. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing thermally broken aluminum-framed entrance doors, hardware, accessories, and other components.
   2. Install thermally broken aluminum-framed entrance doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
   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. Set sill threshold in bed of sealant, as indicated, for weather tight construction.
   7. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   8. Seal joints watertight unless otherwise indicated.

B. 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.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 - JOINT SEALANTS to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 088000 - CONCRETE UNIT MASONRY.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. 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 E783 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 6.24 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. 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. Clean aluminum surfaces immediately after installing aluminum-framed door and storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove non-permanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire rated door and framing systems for installation as sidelights, borrowed Lights, windows, and transoms in interior openings.

1.02 REFERENCES

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021, with Errata (2022).

D. 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).

E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 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 C1036 - Standard Specification for Flat Glass; 2021.

I. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

K. ASTM E2010: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

L. ASTM E2074: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

M. ASTM E413 - Classification for Rating Sound Insulation; 2022.

N. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

O. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

P. BHMA A156 - American National Standards for door hardware.

Q. CPSC 16 CFR 1201 Categories I and II: Safety Standard for Architectural Glazing Materials.

R. NFPA 251: Standard Methods of Tests of Fire Endurance of Building Construction and Materials.

S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

U. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

V. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.03 DEFINITIONS

A. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.04 SUBMITTALS

A. Submit in accordance with Section 013300 - SHEET METAL WORK.

B. Product Data:
1. Technical Information: Submit latest edition of manufacturer’s product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.

C. Shop Drawings:
1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure

D. Structural Calculations:
1. Provide structural calculations sealed by a licensed professional engineer in the State in which the project is located; prepared in compliance with referenced documents and these specifications.

E. Hardware schedule: list of manufacture supplied hardware and verification of cylinder size complying with Section 087100 - PRE-APPLIED SHEET MEMBRANE WATERPROOFING.

F. Samples: For following products:
1. Two 8-inch by 10-inch samples for glass
2. Sample of steel frame
3. Verification of sample of selected finish

G. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

H. Warranties: Submit manufacturer’s warranty.

I. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
1. Separate certification will not be required for glazing materials bearing manufacturer’s permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to:
   1. International Accreditation Service for a Type A Third-Party Inspection Body (Field Services ICC-ES Third-Party Inspections Standard Operating Procedures, 00-BL-S0400 and S0401)
   2. International Accreditation Service for Testing Body-Building Materials and Systems
      a. Fire Testing
         1) ASTM Standards: ASTM E119
         2) CPSC Standards 16 CFR 1201
         3) NFPA Standards 251, 252, 257
         4) UL Standards 9, 10B, 10C, 1784, UL Subject 63

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.

C. Source Limitations for Glazing Accessories: Obtain framing system, glazing and glazing accessories from one source for each product and installation method indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

F. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer’s listing.

G. Regulatory Requirements: Comply with provisions of the following:
   1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA) as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Accessible doors no more than 5 lbf push or pull force
         2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction
   2. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks and Exit Devices: Not more than 15 lbf (67 N(to release the latch, Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15lbf (67 N) to open door to minimum required width.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.
   1. At delivery inspect all containers for damage.
   2. Examine glass and frame units for damage.

3. List all damage to containers on the shipping company's Bill of Lading
4. Report damage to manufacturer immediately.
5. Store glazing materials and frame units in original packing containers
6. Do expose glazing material of frame units to sunlight and weather.
7. Do not store horizontally.
8. Place glass and frames upright, no less than 6 degrees from vertical.
9. Store all materials in dry conditions, off the ground.
10. Protect from construction activities.
11. Fully support Glass units along entire length
12. Glass and frame units must be separated by non-abrasive pads such as cloth or cork.
13. Do not stack containers

1.07 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
   1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other interior and/or exterior envelope components and door hardware beyond that provided by this section

1.08 WARRANTY

A. Provide the Pilkington Pyrostop Fireframes® Series by TGP limited five-year warranty dated from date of shipment from the factory.

PART 2 PRODUCTS

2.01 MANUFACTURERS - FIRE-RATED DOORS AND WALL ASSEMBLIES

A. Glass Material:
   1. Glass Material: Pilkington Pyrostop fire-rated glazing as fabricated and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com. (Basis of Design).
   2. or Approved Equal

B. Frame System:
   1. Frame System: Fireframes Aluminum Series by TGP, fire-rated aluminum frame system as manufactured and supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com. (Basis of Design).
   2. Architect approved equivalent.

2.02 PERFORMANCE REQUIREMENTS

A. Fire Rating Requirements
   1. Duration -- Doors: Capable of providing a fire rating for 60 minutes.
   2. Duration--Opening Applications in fire partitions or area separation walls and corridors where opening protection is specified: Capable of providing 60 minute rating.

B. Delegated design: For the performance requirements listed below requiring structural design provide data, calculations and drawings signed and sealed by an engineer licensed in the state where the project is located.

C. Design Requirements:
   1. Dimensions – Door and Framing:

a. Door framing face dimension: 1 15/16-inch.
b. Depth of door framing: 1 15/16-inch.
c. Door style face dimension: 3 1/8-inch.
d. Door cross rail (if applicable) face: 3 9/16-inch.
e. Depth of stile, header, sill and cross rail: 1 15/16-inch

2. Dimensions -- Window Assembly:
   a. Perimeter framing face dimension: 2 3/4-inch at head, sill and jamb.
   b. Horizontal and/or vertical mullions: 3 9/16-inch on the face.
   c. Depth of perimeter and mullion: 1 15/16-inch.
3. Construction: Narrow-profile, roll-formed steel architectural grade specialty fire doors. Conventional break-shape type hollow metal steel fire-rated doors will not be considered an acceptable substitute for the Fireframes Aluminum Series doors specified in this section as they do not conform to the project design intent and/or aesthetic and quality standards.
   a. Knock down frames are not permitted.

2.03 MATERIALS - GLASS

A. Fire Rated Glazing: ASTM C1036 and ASTM C1048; composed of multiple sheets of glass laminated with an intumescent interlayer glazing material.

B. Impact Safety Resistance: ANSI Z97.1 and CPSC 16 CFR 1201 (Cat. I and II)

C. Thickness of Glazing Material: 7/8" Pilkington Pyrostop 60 minute.

D. Approximate Visible Transmission: Varies with thickness (approximate range 88 percent).

E. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL® only), fire rating period, safety glazing standards, and date of manufacture.

F. Performance: Glass must be rated to stop fire from either direction and must meet all testing requirements including the required hose-stream test (where fire-rating exceeds 20 minutes).

2.04 MATERIALS – FRAMES AND DOORS

A. Aluminum Framing System 60-minute.
   1. Steel Frame: Two halves, nominal 1.9 in. wide (48.3 mm) with a nominal minimum depth of 1.38 in. (35 mm) with lengths cut according to glazing size.
   2. Aluminum Trim: As supplied with steel framing members. Nominal. 2 in. (50.8 mm) wide with a nominal. depth of 1.54 in. (39 mm) with lengths cut according to glazing size.
   3. Stainless Steel Standoffs: As supplied with steel framing members. Nominal. 5/16 in. (8 mm) diameter with a nominal. minimum depth of 1 1/8 in (28 mm) with depth adjusted to match panel thickness.
   4. Stainless Steel Moment and Connecting Braces: As supplied with steel framing members. Nominal. 3/8 in. (10 mm) thick with a nominal. depth of 1 1/8 in (28 mm) with depth adjusted to match panel thickness.
   5. Framing Member Fasteners: As supplied with steel framing members. M6 x 16mm Button Head Socket Cap Screws for frame assembly and 36 x 1" Pan Head Sheet Metal Screws for door installation.
   6. Glazing Gasket: As supplied with steel framing members. Nominal. 3/4 in. (19 mm) by 3/16 in (4.5 mm) black applied to the steel framing members to cushion and seal the glazing material when installed.

B. Steel Framing System including 60-minute rated doors, 60-minute rated windows.
   1. Frame: Steel profiled formed tubing.

2. Fasteners: As recommended by manufacturer
3. Glazing Accessories: calcium silicate setting blocks.
4. Glazing Compounds:
   a. FireLite®, FireLite Plus®, FireLite® NT, FireLite® IGU, Fireglass®20, or Pilkington Pyrostop®: Approved pure silicone sealant Glaze FireLite® panels that exceed 1,393 sq. inches for 90-minute ratings with “Kerafix 2000” glazing tape supplied by manufacturer.

C. Doors:
1. Manufacturer's standard double leaf with manufacturer's standard hardware.
2. Coordinate door hardware with cylinder as specified.

2.05 FABRICATION

A. Furnish frame assemblies pre-welded.
1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
2. Fit with suitable fasteners.
3. Knock-down frames are not permitted

B. Furnish Welded interior frame assemblies.
1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
2. Fit with suitable fasteners.
3. Knock-down door perimeter frames are not permitted

C. Field glaze door and frame assemblies.

D. Factory prepare steel door assemblies and install all hardware.

E. Fabrication Dimensions: Fabricate to fire-rated field dimensions.

F. Obtain approved shop drawings prior to fabrication.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish frames after assembly.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.07 FACTORY FINISHES

A. Color-Coated Finish: Apply manufacturer's standard powder coating finish system complying with AAMA 2605 applied to factory-assembled frames before shipping, complying with manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

2.08 DOOR HARDWARE

A. Furnish hardware with 60 minute fire door by the manufacturer.

B. Select hardware from door manufacturer's standard recommended and approved hardware groups as specified in Division 8 Section 087100 - PRE-APPLIED SHEET MEMBRANE WATERPROOFING.

C. Provide power assisted hardware for use at any door that cannot meet the opening force(s) required by code noted in Part I above.
   1. High energy, power-operated doors must meet the requirements of BHMA A156.10 and power-assisted low energy doors must comply with BHMA A156.19
   2. Operating hardware for Fireframes® Designer Series Active-Active Pair of Doors Outswing with Exit Device. Each pair to have the following.

	ITEM	DESCRIPTION	MANUFACTURER	FINISH
6	Hanging Devices	Weld on Pivots	Technical Glass Products	PTM
2	Exit Device	F9600 Concealed	Dorma	630
2	Lever Trim	ZT08 tubular level handles	Dorma	630
1	Cylinder	ANSI Mortise Schlage C Keyway	Technical Glass Products	626
2	Closing Devices	TS 93 Surface Applied Closer	Dorma	689
2	Auto door Bottoms	420APKL Smoke Seal	Pemko	MA
1	Auxiliary Fire Latch	Used with exit device with no bottom rod	Technical Glass Products	630
1	Weather Seal	Perimeter Gasket	Technical Glass Products	

D. Balance of hardware by others

2.09 * FINISH LEGEND:

A. PTM: Painted to match frame

B. MA: Mill Finish Aluminum

C. 689: Aluminum Paint

D. 630: Satin Stainless Steel

E. 626: Satin Chrome Plated

2.10 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with ASTM D1187/D1187M; Type I.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.

B. Provide openings plumb, square and within allowable tolerances.
   1. Provide 3/8 inch shim space at all walls

C. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

D. Do not proceed until such conditions are corrected.

3.02 INSTALLATION

A. Follow manufacturer's written instructions and approved shop drawings.

B. Install fully welded fire window, door, and wall in strict accordance with the approved shop drawings.

C. Install fire safing / fire stopping at edges of system

D. Install glazing in strict accordance with fire rated glazing material manufacturer's specifications.
   1. Field cutting or tampering is not permissible.

E. Do not install damaged frames or chipped glazing units.

F. Install plumb and true. Limit out of plumb or true to 1/8 inch in 10'-0" in any dimension.

3.03 REPAIR AND TOUCH UP

A. Limited to minor repair of small scratches. Use only manufacturer's recommended products.
   1. Such repairs shall match original finish for quality or material and view.

B. Anodized Finishes:
   1. Protect the anodized finish from harsh chemicals such as concrete/mortar or muriatic acid/brick wash. If reasonable care is taken during handling and high and low pH chemicals can be avoided, repair and/or touch up of an anodized finish will not be needed.
   2. Some rub marks on an anodized finish can be removed with a mild abrasive pad, such as a Scotch-Brite pad, prior to touch up painting.
   3. Touch up paint should be used even more sparingly over anodize. Only the visible raw aluminum in the scratch or gouge should be touched up with a matching paint.

C. Powder Coated Finishes
   1. Limited to minor repairs of small scratches. Use only manufacturer's recommended products.
   2. Such repairs shall match original finish for quality or material and view.
   3. Repairs and touch up not visible from a distance of 5 feet to be approved by Owner and Architect.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.04 ADJUSTING

A. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

3.05 PROTECTION AND CLEANING

A. Protect 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.
   1. Do not clean with astringent cleaners. Use a clean "grit free" cloth and a small amount of mild soap and water or mild detergent.
   2. Do not use any of the following:
      a. Steam jets

b. Abrasives
c. Strong acidic or alkaline detergents, or surface-reactive agents
d. Detergents not recommended in writing by the manufacturer
e. Do not use any detergent above 77 degrees F
f. Organic solvents including but not limited to those containing ester, Ketone, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.
g. Metal or hard parts of cleaning equipment must not touch the glass surface

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. 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 by glass manufacturer.

END OF SECTION

SECTION 084113.16 - FIRE RATED GLASS AND FRAMING SYSTEMS (FIREFRAMES DESIGNER)
H2M

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire rated door and framing systems for installation as vision lights in fire rated doors, full vision fire rated doors, sidelights, borrowed Lights, windows, and transoms in interior and exterior openings.

1.02 REFERENCES

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021, with Errata (2022).

D. 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).

E. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.

F. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

G. 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.

H. 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.

I. ASTM C1036 - Standard Specification for Flat Glass; 2021.

J. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

L. ASTM E2010: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

M. ASTM E2074: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

N. 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).

O. 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).

P. 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).

Q. ASTM E413 - Classification for Rating Sound Insulation; 2022.

R. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

S. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.

T. BHMA A156 - American National Standards for door hardware.

U. CPSC 16 CFR 1201 Categories I and II: Safety Standard for Architectural Glazing Materials.

V. NFPA 251: Standard Methods of Tests of Fire Endurance of Building Construction and Materials.

W. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

X. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

Y. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

Z. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.03 DEFINITIONS

A. Manufacturer: A firm that produces primary glass, fabricated glass or framing as defined in referenced glazing publications.

1.04 SUBMITTALS

A. Submit in accordance with Section 013300 - SHEET METAL WORK.

B. Product Data:
   1. Technical Information: Submit latest edition of manufacturer’s product data providing product descriptions, technical data, Underwriters Laboratories, Inc. listings and installation instructions.

C. Shop Drawings:
   1. Include plans, elevations and details of product showing component dimensions; framed opening requirements, dimensions, tolerances, and attachment to structure

D. Structural Calculations:
   1. Provide structural calculations sealed by a licensed professional engineer in the State in which the project is located; prepared in compliance with referenced documents and these specifications.

E. Hardware schedule: list of manufacture supplied hardware and verification of cylinder size complying with Section 087100 - PRE-APPLIED SHEET MEMBRANE WATERPROOFING.

F. Samples: For following products:
   1. Two 8-inch by 10-inch samples for glass
   2. Sample of steel frame
   3. Verification of sample of selected finish

G. Glazing Schedule: Use same designations indicated on drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

H. Warranties: Submit manufacturer's warranty.

I. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
   1. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to:
   1. International Accreditation Service for a Type A Third-Party Inspection Body (Field Services ICC-ES Third-Party Inspections Standard Operating Procedures, 00-BL-S0400 and S0401)
   2. International Accreditation Service for Testing Body-Building Materials and Systems
      a. Fire Testing
         1) ASTM Standards: ASTM E119
         2) CPSC Standards 16 CFR 1201
         3) NFPA Standards 251, 252, 257
         4) UL Standards 9, 10B, 10C, 1784, UL Subject 63
         5) BS 476; Part 22: 1987
         6) EN 1634-1

B. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

C. Source Limitations for Glazing Accessories: Obtain framing system, glazing and glazing accessories from one source for each product and installation method indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 252. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

E. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by UL, for fire ratings indicated, based on testing according to NFPA 257. Assemblies must be factory-welded or come complete with factory-installed mechanical joints and must not require job site fabrication.

F. Listings and Labels - Fire Rated Assemblies: Under current follow-up service by Underwriters Laboratories® maintaining a current listing or certification. Label assemblies accordance with limits of manufacturer's listing.

G. Regulatory Requirements: Comply with provisions of the following:
   1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA) as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Accessible doors no more than 5 lbf push or pull force
         2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction
   2. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks and Exit Devices: Not more than 15 lbf (67 N(to release the latch, Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15lbf (67 N) to open door to minimum required width.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle under provisions specified by manufacturer.
   1. At delivery inspect all containers for damage.
   2. Examine glass and frame units for damage.
   3. List all damage to containers on the shipping company's Bill of Lading
   4. Report damage to manufacturer immediately.
   5. Store glazing materials and frame units in original packing containers
   6. Do expose glazing material of frame units to sunlight and weather.
   7. Do not store horizontally.
   8. Place glass and frames upright, no less than 6 degrees from vertical.
   9. Store all materials in dry conditions, off the ground.
   10. Protect from construction activities.
   11. Fully support Glass units along entire length
   12. Glass and frame units must be separated by non-abrasive pads such as cloth or cork.
   13. Do not stack containers

1.07 PROJECT CONDITIONS

A. Obtain field measurements prior to fabrication of frame units. If field measurements will not be available in a timely manner coordinate planned measurements with the work of other sections.
   1. Note whether field or planned dimensions were used in the creation of the shop drawings.

B. Coordinate the work of this section with others effected including but not limited to: other interior and/or exterior envelope components and door hardware beyond that provided by this section

1.08 WARRANTY

A. Provide the Pilkington Pyrostop® and Fireframes® Series by TGP limited five-year warranty dated from date of shipment from the factory.

PART 2 PRODUCTS

2.01 MANUFACTURERS - FIRE RATED DOORS AND WINDOWS

A. Glass Material:

1. Glass: Pilkington Pyrostop fire-rated glazing as fabricated and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com. (Basis of Design).
2. or Architect Approved Equivalent.

B. Frame System:
1. Frame System: Fireframes Designer Series by TGP, fire-rated steel frame system as manufactured and supplied by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065 (800-426-0279) fax (800-451-9857) e-mail sales@fireglass.com. (Basis of Design).
2. Frame System: GPX Architectural Series fire-rated frame system as manufactured and supplied by Safti First fire-rated glazing solutions, 100 N. Hill Drive, Suite 12, Brisbane, CA 94005 (888-653-4444); email: info@safti.com.
3. or Architect Approved Equivalent.

2.02 PERFORMANCE REQUIREMENTS

A. Fire Rating Requirements
1. Duration -- Doors: Capable of providing a fire rating for 60 minutes.
2. Duration-- Window Assembly: Capable of providing a fire rating for 60 minutes.
3. Duration--Opening Applications in fire partitions or area separation walls and corridors where opening protection is specified: Capable of providing 60 minute rating.

B. Delegated design: For the performance requirements listed below requiring structural design provide data, calculations and drawings signed and sealed by an engineer licensed in the state where the project is located.

C. Design Requirements:
1. Dimensions – Door and Framing:
a. Door framing face dimension: 1 15/16-inch.
b. Depth of door framing: 1 15/16-inch.
c. Door style face dimension: 3 1/8-inch.
d. Door cross rail (if applicable) face: 3 9/16-inch.
e. Depth of stile, header, sill and cross rail: 1 15/16-inch
2. Dimensions -- Window Assembly:
a. Perimeter framing face dimension: 2 3/4-inch at head, sill and jamb.
b. Horizontal and/or vertical mullions: 3 9/16-inch on the face.
c. Depth of perimeter and mullion: 1 15/16-inch.
3. Construction: Narrow-profile, roll-formed steel architectural grade specialty fire doors. Conventional break-shape type hollow metal steel fire-rated doors will not be considered an acceptable substitute for the Fireframes Designer Series doors specified in this section as they do not conform to the project design intent and/or aesthetic and quality standards.
a. Knock down frames are not permitted.

D. Structural Performance
1. Design and size the system to withstand structural forces placed upon it without damage or permanent set when tested in accordance with ASTM E330/E330M using load 1.5 times the design wind loads and of 10 seconds in duration.
2. Positive wind load: as indicated on the drawings.
3. Negative wind Load:as indicated on the drawings.
4. Member deflection: Limit deflection of the edge of the glass normal to the plane of the glass to 1/175 of the glass edge length or ¾ inch, whichever is less of any framing member
5. Accommodate movement between storefront and adjoining systems

E. Air infiltration: Provide systems that allow a maximum air leakage through fixed glazed openings of 0.06 cfm/sq. ft. of area when tested per ASTM E283 at a static air differential of 6.24 lbf/sq ft

F. Water Penetration
   1. Under Static pressure, provide systems that do not show uncontrolled water leakage when tested according to ASTM E331 under static pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
   2. Under Dynamic pressure, provide systems that do not show uncontrolled water leakage when tested according to AAMA 501.1 under static pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

2.03 MATERIALS - GLASS

A. Fire Rated Glazing: ASTM C1036 and ASTM C1048; composed of multiple sheets of glass laminated with an intumescent interlayer glazing material.

B. Impact Safety Resistance: ANSI Z97.1 and CPSC 16 CFR 1201 (Cat. I and II)

C. Thickness of Glazing Material: 7/8" Pilkington Pyrostop 60 minute.

D. Approximate Visible Transmission: Varies with thickness (approximate range 88 percent).

E. Logo: Each piece of fire-rated glazing shall be labeled with a permanent logo including name of product, manufacture, testing laboratory (UL® only), fire rating period, safety glazing standards, and date of manufacture.

F. Performance: Glass must be rated to stop fire from either direction and must meet all testing requirements including the required hose-stream test (where fire-rating exceeds 20 minutes).

2.04 MATERIALS – FRAMES AND DOORS

A. Steel Framing System including 60-minute rated doors, 60-minute rated windows.
   1. Frame: Steel profiled formed tubing.
   2. Fasteners: As recommended by manufacturer
   3. Glazing Accessories: calcium silicate setting blocks.
   4. Glazing Compounds:
      a. FireLite®, FireLite Plus®, FireLite® NT, FireLite® IGU, Fireglass®20, or Pilkington Pyrostop®: Approved pure silicone sealant Glaze FireLite® panels that exceed 1,393 sq. inches for 90-minute ratings with “Kerafix 2000” glazing tape supplied by manufacturer.
         1) When glazed with Pilkington Pyrostop (60-90 minutes) glazing products, doors meet the maximum transmitted temperature rise of not more than 450 degrees Fahrenheit (250 degrees Celsius) at the end of 30 minutes of the standard fire test exposure.

B. Doors:
   1. Manufacturer's standard double leaf with manufacturer's standard hardware.
   2. Coordinate door hardware with cylinder as specified.

2.05 FABRICATION

A. Furnish frame assemblies pre-welded.
   1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
   2. Fit with suitable fasteners.

3. Knock-down frames are not permitted

B. Furnish Welded interior frame assemblies.
1. When necessary, splice frames too large for shop fabrication or shipping or to fit in available building openings.
2. Fit with suitable fasteners.
3. Knock-down door perimeter frames are not permitted

C. Field glaze door and frame assemblies.

D. Factory prepare steel door assemblies and install all hardware.

E. Fabrication Dimensions: Fabricate to fire-rated field dimensions.

F. Obtain approved shop drawings prior to fabrication.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish frames after assembly.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable. Noticeable variations in the same piece are not acceptable.

2.07 FACTORY FINISHES

A. Color-Coated Finish: Apply manufacturer's standard powder coating finish system complying with AAMA 2605 applied to factory-assembled frames before shipping, complying with manufacturer's written instructions for surface preparation including pretreatment, application, and minimum dry film thickness.

B. Color and Gloss: As selected by Architect from manufacturer's full range.

C. Acceptable Manufacturers:
1. Tiger Drylac
2. Additional manufacturers as approved by TGP

2.08 DOOR HARDWARE

A. Furnish hardware with 45 minute fire door by the manufacturer.

B. Select hardware from door manufacturer's standard recommended and approved hardware groups as specified in Division 8 Section 087100 - PRE-APPLIED SHEET MEMBRANE WATERPROOFING.

C. Provide power assisted hardware for use at any door that cannot meet the opening force(s) required by code noted in Part I above.
1. High energy, power-operated doors must meet the requirements of BHMA A156.10 and power-assisted low energy doors must comply with BHMA A156.19

D. Operating hardware for Fireframes® Designer Series Active-Active Pair of Doors Outswing with Exit Device. Each pair to have the following.

ITEM	DESCRIPTION	MANUFACTURER	FINISH

6	Hanging Devices	Weld on Pivots	Technical Glass Products	PTM
2	Exit Device	F9600 Concealed	Dorma	630
2	Lever Trim	ZT08 tubular level handles	Dorma	630
1	Cylinder	ANSI Mortise Schlage C Keyway	Technical Glass Products	626
2	Closing Devices	TS 93 Surface Applied Closer	Dorma	689
2	Auto door Bottoms	420APKL Smoke Seal	Pemko	MA
1	Auxiliary Fire Latch	Used with exit device with no bottom rod	Technical Glass Products	630
1	Weather Seal	Perimeter Gasket	Technical Glass Products	

E. Balance of hardware by others

2.09 * FINISH LEGEND:

A. PTM: Painted to match frame

B. MA: Mill Finish Aluminum

C. 689: Aluminum Paint

D. 630: Satin Stainless Steel

E. 626: Satin Chrome Plated

2.10 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with ASTM D1187/D1187M; Type I.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and members to which the work of this section attaches or adjoins prior to frame installation.

B. Provide openings plumb, square and within allowable tolerances.
   1. Provide 3/8 inch shim space at all walls

C. Notify Architect of any conditions which jeopardize the integrity of the proposed fire wall / door system.

D. Do not proceed until such conditions are corrected.

3.02 INSTALLATION

A. Follow manufacturer’s written instructions and approved shop drawings.

B. Install fully welded fire window, door, and wall in strict accordance with the approved shop drawings.

C. Install fire safing / fire stopping at edges of system

D. Install glazing in strict accordance with fire rated glazing material manufacturer’s specifications.

1. Field cutting or tampering is not permissible.

E. Do not install damaged frames or chipped glazing units.

F. Install plumb and true. Limit out of plumb or true to 1/8 inch in 10’-0” in any dimension.

3.03 REPAIR AND TOUCH UP

A. Limited to minor repair of small scratches. Use only manufacturer’s recommended products.
   1. Such repairs shall match original finish for quality or material and view.

B. Anodized Finishes:
   1. Protect the anodized finish from harsh chemicals such as concrete/mortar or muriatic acid/brick wash. If reasonable care is taken during handling and high and low pH chemicals can be avoided, repair and/or touch up of an anodized finish will not be needed.
   2. Some rub marks on an anodized finish can be removed with a mild abrasive pad, such as a Scotch-Brite pad, prior to touch up painting.
   3. Touch up paint should be used even more sparingly over anodize. Only the visible raw aluminum in the scratch or gouge should be touched up with a matching paint.

C. Powder Coated Finishes
   1. Limited to minor repairs of small scratches. Use only manufacturer's recommended products.
   2. Such repairs shall match original finish for quality or material and view.
   3. Repairs and touch up not visible from a distance of 5 feet to be approved by Owner and Architect.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged.

3.04 ADJUSTING

A. Adjust door function and hardware for smooth operation. Coordinate with other hardware suppliers for function and use of any other attached hardware.

3.05 PROTECTION AND CLEANING

A. Protect 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.
   1. Do not clean with astringent cleaners. Use a clean “grit free” cloth and a small amount of mild soap and water or mild detergent.
   2. Do not use any of the following:
      a. Steam jets
      b. Abrasives
      c. Strong acidic or alkaline detergents, or surface-reactive agents
      d. Detergents not recommended in writing by the manufacturer
      e. Do not use any detergent above 77 degrees F
      f. Organic solvents including but not limited to those containing ester, Ketone, alcohols, aromatic compounds, glycol ether, or halogenated hydrocarbons.
      g. Metal or hard parts of cleaning equipment must not touch the glass surface

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. 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 by glass manufacturer.

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 conventionally glazed aluminum curtain walls installed as assemblies.

1.03 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by preconstruction testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.
      a. Basic Wind Speed: 130 mph.
      b. Importance Factor: III.
      c. Exposure Category: B.
   2. Blast Loads: As indicated on Drawings.
   3. Periodic Maintenance-Equipment Loads: As indicated on Drawings.

D. Structural-Test Performance: Test according to ASTM E330/E330M as follows:
   1. A static air design load of 42 psf (2010 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330.
   2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, 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 less than 10 seconds.

E. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
      a. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller. Delete first subparagraph below if no operable windows or doors.

b. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

2. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.

F. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. Component Resistance Factor: 1.5
2. When tested to AAMA 501.6, system must meet dynamic seismic drift causing glass cracking (Cracking) or glass fallout (Fallout) of 6” or 0.0300 times the story height.

G. Story Drift: Accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
2. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.

H. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).

I. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft. (720 Pa).
1. Maximum Water Leakage: According to AAMA 501.1 No uncontrolled water penetrating assemblies or water appearing on assemblies' 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.

J. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
3. 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 for a minimum 3 cycles.

K. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC.
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than.24 (Summer - Day) and 0.30 (Winter-Night) as determined according to NFRC 100.
2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.35 as determined according to NFRC 200.
3. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. value of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
4. Condensation Resistance Factor (CRF): Fixed glazing and framing areas shall have an NFRC- certified condensation resistance rating of no less than 88 (Frame) / 73 (Glass) as determined according to AAMA 1503.

L. Sound Transmission: Provide glazed aluminum curtain walls with fixed glazing and framing areas having the following sound-transmission characteristics:

1. Outdoor-Indoor Transmission Class: Minimum 29 when tested for laboratory sound transmission loss according to ASTM E90 and determined by ASTM E1332.
2. Sound Transmission Class (STC): Minimum 34 when tested to AAMA Specification 1801 and in accordance with ASTM E1425 and ASTM E90.

M. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

1.04 PRE-CONSTRUCTION TESTING

A. Preconstruction Testing Service: Provide glazed aluminum curtain walls that comply with test-performance requirements indicated, as evidenced by reports based on Project-specific preconstruction testing by a qualified testing agency.
1. Owner will engage a qualified testing agency to perform preconstruction testing on laboratory mockups.
2. Build laboratory mockups at testing agency facility using personnel, materials, and methods of construction that will be used at Project site.
3. Notify Architect five days in advance of the dates and times when laboratory mockups will be constructed.
4. Preconstruction Testing Program: Perform tests specified in "Performance Requirements" Article on laboratory mockups in the following order:
   a. Structural-performance preloading at 50 percent of the specified wind-load design pressure when tested according to ASTM E330/E330M.
   b. Air infiltration when tested according to ASTM E283.
   c. Water penetration under static pressure when tested according to ASTM E331.
   d. Water penetration under dynamic pressure when tested according to AAMA 501.1.
   e. Structural performance at design load when tested according to ASTM E330/E330M.
   f. Repeat air filtration when tested according to ASTM E283.
   g. Repeat water penetration under static pressure when tested according to ASTM E 331.
   h. Structural performance at maximum 150 percent of positive and negative wind-load design pressures when tested according to ASTM E330/E330M.
   i. Condensation Resistance Factor (CRF) Test units in accordance with AAMA 1503.1
   j. Thermal Resistance (U-Factor). Test units in accordance with NFRC 500.

1.05 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 glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
   a. Joinery, including concealed welds.
   b. Anchorage.
   c. Expansion provisions.
   d. Glazing.
   e. Flashing and drainage.
3. Include laboratory mockup Shop Drawings, prepared by a qualified preconstruction testing agency, showing details of laboratory mockup.
   a. Resubmit Shop Drawings with changes made to glazed aluminum curtain walls to successfully complete preconstruction testing.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300 mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

E. Delegated-Design Submittal: For glazed aluminum curtain walls 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 qualified Installer.

B. Seismic Qualification Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

C. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency, for glazed aluminum curtain walls, indicating compliance with performance requirements.

E. Field quality-control reports.

F. Warranties: Sample of special warranties.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating glazed aluminum curtain walls that meet or exceed energy performance requirements indicated and of documenting this performance by certification, labeling, and inclusion in lists.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM E699 for testing indicated.

D. Product Options: 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.

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. Energy Performance Standards: Comply with NFRC for minimum standards of energy performance, materials, components, accessories, and fabrication. Comply with more stringent requirements if indicated.
   1. Provide NFRC-certified glazed aluminum curtain walls with an attached label.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
   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.

1.09 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain walls by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain walls 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 created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: 2 years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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. Kawneer North America; an Alcoa company. - 2 inch (1620UT Wall System SSG System) Wall System. (Basis of Design)
2. YKK AP America Inc.
3. EFCO Corporation.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B221: 6063-T6 alloy and temper or recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8) wall thickness at any location for the main frame.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B209 (ASTM B209M).
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).
   3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
   4. Structural Profiles: ASTM B308/B308M.
   5. Extruded Aluminum: 6063-T6 alloy and temper.

C. 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.

2.03 FRAMING

A. Framing Members: 2 inch (1620UT Wall System SSG System) inch wide manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads. 7 1/2 inch system depth minimum. Tested to AAMA 501 and TAS 202.
   1. Construction: Thermally broken.
   2. Glazing System: outside glazed, retained mechanically with gaskets on four sides.
   3. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners 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.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.

D. 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.

E. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer. All steel anchors shall be properly insulated from the aluminum.

F. Pressure Plate: Pressure plate shall be either aluminum or fiberglass and fastened to the mullion with stainless steel screws. Fiberglass pressure plate shall be tested to ASTM D6938, ASTM D790, ASTM D695, ASTM D953 and ASTM D3846.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Framing Sealants: Manufacturer's standard sealants.

I. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides for a minimum separation from interior to exterior metal of ¼" (6mm).

J. Tolerances: Reference 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.

2.04 GLAZING

A. Glazing: Comply with Section 088000 - GLAZING.

B. Framing Members: Manufacturer's standard extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Glazing System: 4-sided captured.
   2. Glazing Plane: Front.

C. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers. Gaskets shall meet the requirements of ASTM C864.

D. Glazing Sealants: As 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. 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."

E. Spacing and Setting Blocks: Manufacturer's standard elastomeric type.

F. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.05 OPERABLE UNITS

A. Doors: Comply with Section 084113 - ALUMINUM FRAMED ENTRANCES AND STOREFRONTS.

2.06 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.07 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. All aluminum vertical and horizontal extrusions shall have a minimum wall thickness of .093" to .125".

C. 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.
   3. Frame components shall be mechanically fastened by means of extruded aluminum shear blocks attached to the vertical mullions.
   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 exterior. Outside glazed curtain wall system shall be dry glazed with an exterior aluminum pressure plate and snap cover with interior and exterior
   7. Provisions for safety railings mounted between mullions at interior.
   8. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   9. Curtain wall system is able to accommodate separate interior and exterior finishes and colors.

D. Fabricate components that, when assembled, have the following characteristics:
   1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
   2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.08 ALUMINUM FINISHES

A. Kawneer Permanodic™ (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, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.02 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

3.03 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure non-movement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
   7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive 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.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Section 088000 - GLAZING.

3.04 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6 mm in 12 m).
   2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6 mm in 12 m).
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).
   4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m); 1/2 inch (12.7 mm) over total length.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 0.06 cfm / sq. ft. of fixed wall area when tested according to ASTM E783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
   a. Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
   b. Perform a minimum of three tests in areas as directed by Architect.
   c. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
2. Water Penetration: Areas shall be tested according to ASTM E1105 at a minimum cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.
   a. Test Area: One bay wide, but not less than 30 feet (9.1 m), by one story of glazed aluminum curtain wall.
   b. Perform a minimum of three tests in areas as directed by Architect.
   c. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
3. Water Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
   a. Test Area: A minimum area of 45 feet (18 m) by one story of glazed aluminum curtain wall.

C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 ADJUSTING, CLEANING AND PROTECTION

A. Protection: Protect installed product’s finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: 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.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period

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 aluminum windows including trims and accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

D. Environmental Product Declaration (EPD):
   1. Include a Type III Product-Specific EPD created from a Product Category Rule.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination.”

1.06 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:
   a. Window units: 2 years from date of Substantial Completion.
   b. Painted Metal Finishes:
      1) Five years from date of Substantial Completion for an AAMA 2603 Baked Enamel Finish
      2) Ten years from date of Substantial Completion for an AAMA 2604 High-Performance Finish
      3) Twenty years from date of Substantial Completion for an AAMA 2605 High-Performance Finish

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:

B. 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: an Alcoa company: GLASSvent UT Vent units.
      a. Project-Out Windows
         1) 4-3/8" (111.1 mm); 5-1/8" (130.2 mm) Overall System Depth
            (a) AW-PG80-AP(with Roto Operator and Hook Lock)
      b. Outswing Casement Windows
         1) 4-3/8" (111.1 mm); 5-1/8" (130.2 mm) Overall System Depth
            (a) AW-PG80-C (with Roto Operator and Hook Lock)
   2. Architect approved equivalent.

C. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.02 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class AW - Architectural Window. Designation: HS-AW70 - 99 inches by 79 inches (XX).
   2. Structural Performance:
      a. Uniform Load Structural Test: 150 percent of Design Pressure.

C. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch (19 mm), whichever is less, at design pressure based on testing performed according to AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS), Uniform Load Deflection Test or structural computations.

D. Uniform Load Deflection: A minimum static air pressure difference of 70 psf (3352 Pa) shall be applied in the positive and negative direction in accordance with ASTM E330/E330M. There shall be no deflection in excess of L/175 of the span of any framing member.

E. Uniform Load Structural Test: A minimum static air pressure difference of 105 psf (5027 Pa) shall be applied in the positive and negative direction in accordance with ASTM E330/E330M. The unit shall be evaluated after each load.

F. Thermal Transmittance: When tested to AAMA 1503, AAMA specification 507 or NFRC 100 the thermal transmittance (U-Factor) shall not be more than:
   1. Fixed Units: U-factor of 0.38 Btu/sq. ft. x h x deg F for fixed windows.
   2. Operable Units: U-Factor of 0.38 BTU/hr/sf/°F. (Based on center of glass U-Factor range 0.10 to 0.48) with a 10 lb. Sill.

G. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of.30.

H. Air Infiltration:
   1. Tested in accordance with ASTM E283. Air leakage rate shall not exceed 0.10 cfm/ft2 at a static air pressure differential of 6.2 psf.

I. Water Resistance:
   1. Water Resistance: The test specimen shall be tested in accordance with ASTM E547 and ASTM E331. There shall be no leakage as defined in the test method at a static air pressure differential of 15 psf (720 Pa).

J. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503:
   1. Kawneer GLASSvent Units:
      a. 1" (25.4 mm) clear insulating glass with aluminum spacer:
         1) Project-Out: CRF not less than 73 (frame) and 60 (glass).

K. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.

L. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC): When tested to AAMA 1801 and in accordance with ASTM E1425 and ASTM E90, the STC and OITC Rating shall not be less than:
   1. 1" (25.4 mm) insulating glass made with exterior 3/16" (4.76 mm) clear glass, 3/8" (9.52 mm) aluminum spacer, and interior 7/16" (11.11 mm) laminated clear glass:
      a. Project-Out: STC not less than 37; OITC not less than 30.

M. Forced-Entry Resistance: Comply with Performance Grade 10 requirements when tested according to ASTM F588.

N. Blast Mitigation Performance: Shall be tested or proven through analysis to meet ASTM F1642/F1642M, GSA TS01, and UFC 4-010-01 performance criteria.

O. Environmental Product Declarations (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule

2.03 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070 inch wall thickness at any location for the main frame and sash members.

B. Thermal Barrier: The thermal barrier shall consist of integral structural thermal break made with glass-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

C. Thermal Barrier:
   1. Thermal Barrier: The thermal barrier shall be Kawneer IsoLock™ with a nominal 3/8" (9.53 mm) separation consisting of a two-part, chemically curing high density polyurethane which is mechanically and adhesively bonded to the aluminum.

D. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.

E. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

F. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

G. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

2.04 ALUMINUM WINDOWS

A. Basis-of-Design:
   1. Kawneer Company Inc.: GLASSvent UT Units.
   2. Architect approved equivalent.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Projected
   2. Casement

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Glazing
   1. Glazing System: Glazing method shall be a wet/dry type in accordance with manufacturer’s standards. Exterior glazing shall be silicone back bedding sealant. Interior glazing shall be snap-in type glazing beads with an interior gasket in accordance with AAMA 701/702 or ASTM C864.
   2. See Section 088000 - GLAZING for additional information.

E. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

F. Hardware: 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 windows, and sized to accommodate sash weight and dimensions.
   1. Project-Out / Outswing Casement Windows: Provide the following operating hardware:
      a. Stainless Steel 4-Bar Hinges
      b. Cast White Bronze Cam Locking Handles
      c. Cast white Bronze Cam Handle with Pole Ring

2.05 ACCESSORIES

A. Exterior Panning and Interior Trims: Extruded aluminum, 6063-T6 alloy and temper, extruded to profiles and details indicated. Seal exterior joints with manufacturer's standard sealant to assure water-tight joints.
   1. Interior Trim: The interior face trim minimum wall thickness shall be 0.062". The face trim shall snap-fit onto concealed mounting clip. The mounting clip shall be extruded aluminum of 6063-T6 alloy and temper. The minimum wall thickness shall be 0.062" The trim clips shall be provided in 4 inch lengths and spaced a maximum of 18" center to center. Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

B. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, non-migrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.

C. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

D. Sealants and joint fillers for joints at perimeter of window system as specified in Section 079200 - JOINT SEALANTS.

E. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.06 FABRICATION

A. Framing Members, General: Fabricate windows in sizes indicated that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fit joints; make joints flush, hairline and weatherproof.
   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.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Window Frame Joinery: Mitered and Mechanically clipped and/or staked. Factory sealed frame and corner joints.

C. Fabricate aluminum windows that are re-glazable without dismantling sash or framing

D. Thermally Broken Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier. Thermal barriers shall be designed in accordance with AAMA TIR A8.
   1. Thermal Barrier: The thermal barrier shall consist of integral structural thermal break made with glass-reinforced nylon strips installed continuously and mechanically bonded to the aluminum.

E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.

F. Sub frames: Provide sub frames with anchors for window units as shown, of profile and dimensions indicated but not less than 0.093" (2.4 mm) thick extruded aluminum. Miter or cope corners, and join with concealed mechanical joint fasteners. Finish to match window units. Provide sub frames capable of withstanding design loads of window units.

G. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section “Glazing” and with AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS).

H. Glazing Stops: Provide snap-on glazing stops coordinated with Division 08 Section “Glazing” and glazing system indicated. Provide glazing stops to match frame.

I. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

J. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

K. Window Assemblies: Provide fixed units in configuration indicated. Provide window frames, sashes, hardware, and other trim and components necessary for a complete, secure, and weathertight installation, including the following:
   1. Exterior head and sill casings and trim.

L. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: 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.

2.08 ALUMINUM FINISHES

A. Factory Finishing:
   1. Kawneer Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating Color: As selected by the Architect form manufacturer's full color range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
   1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:
   1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
   2. Air-Infiltration Testing:
      a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
      b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
   3. Water-Resistance Testing:

a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
b. Allowable Water Infiltration: No water penetration.

4. Test Reports: Prepared according to AAMA 502.

C. Remove and replace noncomplying windows and retest as specified above.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.04 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
1. Keep protective films and coverings in place until final cleaning.

C. Clean glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove non-permanent labels, and clean surfaces.

D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automatic self closing security service window.

1.02 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

D. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact; 2017.

E. UL 752 - Standard for Bullet-Resisting Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.

B. Preinstallation Meeting: Prior to start of installation arrange a meeting on site to familiarize installer and installers of related work with requirements relating to this work.

1.04 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.

C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.

D. Test Data: Test reports for specific window model and glazing to be furnished, showing compliance with all specified requirements; window and glazing may be tested separately, provided window test sample adequately simulates the glazing to be used.

E. Samples for Selection of Finishes:
   1. Applied Finishes: Color charts for factory finishes.

F. Manufacturer Qualification Statement.

G. Installer Qualification Statement.

H. Testing Agency Qualification Statement.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent testing agency with documented experience in conducting tests of the type specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.

B. Store units in area protected from exposure to weather and vandalism.

1.07 WARRANTY

A. See Section 017800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SERVICE WINDOW UNITS WITH PASS-THROUGH DEVICE

A. Manufacturer
   1. C.R. Laurence, Inc.
   2. Architect approved equivalent.

B. Location: Built within interior wall, as indicated on drawings.

C. Type of Use: As indicated on drawings.

D. Window Type: Exchange Window.
   1. Operation: Self-closing manual.
   2. Overall Window Frame Size: As indicated on drawings.
   3. Frame Material: Aluminum.
      a. Finish: Custom kynar color.

E. Glazing: Safety rated laminated glass, clear, and safety film.
   1. Thickness: 1/2 inch glass safety lmainated glass, 8 mil safety rated film (3M S80 or approved equal)

F. Pass-Through Device: Drawer or Shelf mounted below window and deal tray built into window sill.
   1. Operation: Self closing.
   2. Transaction Shelf Size: 24 inch wide by 2 1/2 inch high by 12 inch deep (610 mm wide by 51 mm high by 305 mm deep) with built-in Deal Tray or as indicated on the drawings.
   3. Material: Stainless steel.
   4. Finish Color: Custom kyrar color.

G. Counter Staging Area: Attendant-side.

H. Products:
   1. US Aluminum CRL Model: SCDW1804.
   2. Architect approved equivalent.

2.02 COMPONENTS

A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
   1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
   2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
   3. Apply factory finish to all exposed surfaces.
   4. Apply bituminous paint to concealed metal surfaces in contact with cementitious or dissimilar materials.
   5. Self-Closing Operation: Manual open and self-closing with auto-locking handles and magnetic hold-open device.
   6. Configuration: As indicated on the drawings.

2.03 MATERIALS

A. Aluminum Extrusions: Minimum 1/8 inch (3.2 mm) thick frame and sash material complying with ASTM B221 and ASTM B221M.
   1. Mill Finished Aluminum Surfaces: Custom kynar color.
   2. Finish: Class I natural anodized.

B. Stainless Steel: Type 304 with No. 4 - Brushed finish.

C. Safety Security Film: Silicone is applied to the security film, one faces; complying with performance level indicated.
   1. Film: 8 Mil Level 3 (3M S80 or approved equal

D. Full weather proof/ smoke proof poly-pile seals. Seals shall meet required smoke development of 0-450.

E. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

2.04 FINISHES

A. Color: Custom Kyrar Finish: AAMA2605. Primer coat, color coat, clear topcoat not less thn 1.5 mils (0.04064 mm) thick.

2.05 ACCESSORIES

A. Hardware and Security Devices for Sliding Windows:
   1. Auto-Lock Handle: Stainless steel auto-locking handle on all self-closing sliders to prevent intrusion.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.

C. Notify Architect/Engineer if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units in correct orientation (inside/outside or secure/non-secure).

C. Anchor units securely in manner so as to achieve performance specified.

D. Full weather proof poly-pile seals.

E. Remove and replace defective work.

3.03 ADJUSTING

A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure and a tight fit at the contact points; lubricate operating hardware.

3.04 CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean exposed surfaces promptly after installation without damaging finishes.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain operable units.
   1. Instructor: Manufacturer's training personnel.
   2. Location: At project site.
   3. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

A. Provide temporary protection to ensure that service and teller windows are without damage upon 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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. 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 E 1300 by a qualified 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: 130 mph.
      c. Importance Factor: 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.

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 (250 deg C), and the fire-resistance rating in minutes.

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. Install glazing in mockups specified in Section 084113 - Aluminum-Framed Entrances and Storefronts, as applicable, to match glazing systems required for Project, including glazing methods.

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: 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. Vitro Architectural Glass Industries, Inc.; SunClean

C. Tinted Float Glass: Class 2, complying with other requirements specified.
1. Basis-of-Design Product: Subject to compliance with requirements, provide glass by Vitro Architectural Glass or comparable product by one of the following:
a. Vitro Architectural Glass.
b. Guardian Industries.
2. Tint Color: SolarBronze and As selected by the Architect.

2.03 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; 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 Clear and SolarBronze by Vitro Industries or comparable product by one of the following:
a. EFCO.
b. Guardian Industries.
2. Tint Color: SolarBronze.
3. Visible Light Transmittance: 76 for Clear glazing and 54 for Gray Tinted glazing percent minimum.

D. Ceramic-Coated Spandrel Glass: ASTM C 1048, Kind FT, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
1. Basis-of-Design Product: Subject to compliance with requirements, provide PPG or comparable product by one of the following:
2. Tint Color: SolarBronze
3. Ceramic Coating Color: Match.

2.04 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, 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 C 1172, 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.

2.05 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 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.

2.06 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. 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. Architect approved equivalent.

2.07 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.

2.08 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 C 509, 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.

2.09 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 C 920, 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.

2.10 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 C 1281 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.

2.11 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.

2.12 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.

2.13 MONOLITHIC-GLASS TYPES

A. Glass Type MG-1 Clear fully tempered float glass.
   1. Thickness: 1/4 inch (6.0 mm) as indicated on the drawings.
   2. Provide safety glazing labeling.

B. Glass Type MG-2: Polished wired glass.
   1. Thickness: 8.0 mm.
   2. Square (Baroque) wire pattern with applied 7 mil safety film.
   3. Weight: 3.0 lbs. / sq. ft.
   4. STC Rating: STC 28
   5. Manufacturer: SaftiFirst "SuperI-W " or Architect approved equivalent.
   6. CSPC 16 CFR 1201 Cat. I and II.

2.14 INTERIOR LAMINATED-GLASS TYPES

A. Glass Type ILG-1: Clear laminated glass with two plies of fully tempered float glass with etched surface pattern.
   1. Thickness of Each Glass Ply: 0.118 inch (3.0 mm).
   2. Interlayer Thickness: 0.090 inch (2.29 mm).
   3. Provide safety glazing labeling.
   4. Provide acid-etched banding as indicated on the drawings.

B. Glass Type ILG-2: Fire-rated laminated glass
   1. Thickness: 8.0 mm.
   2. Provide safety glazing label- CSPC 16 CFR 1201 Cat. I and II.
   3. Manufacturer: TGP Firelite Plus; McGrory Glass Pyran Platinum L or Architect approved equivalent.

2.15 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 SolarBan 60 SolarBronze glass.
   3. Interspace Content: Air (5%) / Argon (95%).
   4. Interspace Gap Size: 1/2 inch
   5. Interior Glass Lite: 1/4 inch tempered StarPhire glass.

B. Exterior Glass Type EIG-1: Low-E coated, insulating glass.
   1. Overall Unit Thickness: 1 inch.
   2. Exterior Glass Lite: 1/4 inch tempered Solarban 60 Low-E (2) SolarBronze glass.
   3. Interspace Content: Air (5%) / Argon (95%).
   4. Interspace Gap Size: 1/2 inch
   5. Indoor Glass Lite: 1/4 inch tempered StarPhire glass
   6. Visible Light Transmittance: 42 percent minimum.
   7. Winter Nighttime U-Factor: 0.24 maximum.
   8. Solar Heat Gain Coefficient:0.21 maximum.
      NOTE:
   9. Provide Walker Custom Patterned glazing in patterns and locations noted on the drawings.

C. Glass Type EIG-2: Spandrel Glass - ICD OPACI-COAT-300 Silicone Opacifier coating, Low-E, insulating spandrel glass.
   1. Overall Unit Thickness: 1 inch.
   2. Thickness of Exterior Glass Lite: 1/4 inch fully tempered Solarban 60 (2) SolarBronze and SolarGray glass.
   3. Interspace Content: Air (5%) / Argon (95%).
   4. Interspace Gap Size: 1/2 inch
   5. Indoor Lite: 1/4 inch fully tempered Clear with ICD OPACI-COAT-300 Silicone Opacifier coating (4).
   6. Opacifier Color: Match Glazing configuration appearance. or as selected by the Architect to match glazing system.
   7. Winter Nighttime U-Factor: 0.24 maximum.

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

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Safety and security window film.

B. Anti-graffiti window film.

C. Film attachment systems.

1.02 REFERENCES

A. ASHRAE - American Society for Heating, Refrigeration, and Air Conditioning Engineers; Handbook of Fundamentals.

B. ASTM International (ASTM):
1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
2. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
3. ASTM D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
4. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting.
5. ASTM D1044 - Standard Method of Test for Resistance of Transparent Plastics to Surface Abrasion (Taber Abrader Test).
6. ASTM D2240 - Standard Method for Rubber Property - Durometer Hardness.
7. ASTM D2582 - Standard Test Method for Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
8. ASTM D5895 - Standard Test Methods for Evaluating Drying or Curing During Film Formation of Organic Coatings Using Mechanical Recorders.
9. ASTM D4830 - Standard Test Methods for Characterizing Thermoplastic Fabrics Used in Roofing and Waterproofing.
10. ASTM E84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
11. ASTM E903 - Standard Methods of Test for Solar Absorbence, Reflectance and Transmittance of Materials Using Integrating Spheres.
12. 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.
13. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.
14. ASTM F1642 - Standard Method of Test for Glazing and Glazing Systems Subject to Airblast Loadings.
15. ASTM F2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loadings.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

D. Consumer Products Safety Commission 16 CFR, Part 1201 - Safety Standard for Architectural Glazing Materials.

E. GSA-TS01-2003 -- Standard Test for Glazing and Glazing Systems Subject to Airblast Loadings.

F. ISO 16933, International Standard for Glass in Building: Explosion-resistant security glazing - Test and classification for arena air-blast testing.

G. Underwriters Laboratories Inc. (UL): UL 972 - Burglary Resisting Glazing Material.

1.03 PERFORMANCE REQUIREMENTS

A. Safety Glazing Impact Performance:
1. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass.
2. Impact Resistance after Aging: 400 ft-lbs, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film applied on 1/8 inch annealed glass.
3. 400 ft-lbs impact resistance, meeting 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass.
4. 150 ft-lbs impact resistance, meeting ANSI Z97.1 (Class B, Unlimited) and 16 CFR 1201 (Category 1) impact requirements with film applied on 1/4 inch annealed glass
5. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) or 16 CFR 1201 (Category 2) impact requirements with film applied on 1/4 inch annealed glass
6. 150 ft-lbs impact resistance, meeting ANSI Z97.1 (Class B, Unlimited) and 16 CFR 1201 (Category 1) impact requirements with film applied on 1/4 inch annealed glass
7. 400 ft-lbs impact resistance, meeting ANSI Z97.1 (Class A, Unlimited) and 16 CFR 1201 (Category 2) impact requirements with film is applied on 1/4 inch annealed glass

B. Blast Hazard Mitigation Performance:
1. GSA Rating of "2"/ ASTM F1642 "No Hazard" with minimum blast load of 7 psi and 43 psi (*msec), on 1/4 inch (6 mm) single pane glass and film attachment system.
2. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with minimum blast load of 9 psi and 60 psi*msec, on 1 inch (25 mm) double pane glass and film attachment system.
3. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with minimum blast load of 5 psi and 28 psi*msec, on 1/4" single pane glass without film attachment system.
4. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with minimum blast load of 11 psi and 65 psi*msec, on 1 inch (25 mm) double pane glass without film attachment system.
5. GSA Rating of "2"/ ASTM F1642 "No Hazard" with minimum blast load of 9 psi and 63 psi*msec, on1/4" single pane glass and film attachment system.
6. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with minimum blast load of 10 psi and 89 psi*msec, on 1 inch (25 mm) double pane glass and film attachment system.
7. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with minimum blast load of 5 psi and 28 psi*msec, on 1/4" pane glass without film attachment system.
8. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast minimum load of 10 psi and 42 psi*msec, on 1 inch (25 mm) double pane glass without film attachment system.
9. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 6 psi and 45 psi*msec, on 1/4 inch (6 mm) single pane glass and film attachment system.
10. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 9 psi and 60 psi*msec, on 1 inch (25 mm) double pane glass and film attachment system.
11. GSA Rating of "3B" with minimum blast load of 4 psi and 28 psi*msec, on 1/4 inch (6 mm) single pane glass and film attachment system.
12. GSA Rating of "3B" with minimum blast load of 10 psi and 89 psi*msec, on 1 inch (25 mm) double pane glass and film attachment system.
13. GSA Rating of "3B" / ASTM F1642 "Minimal Hazard" with minimum blast load of 6 psi and 41 psi*msec, on 1/4 inch (6 mm) single pane glass and film attachment system.
14. GSA Rating of "2" with minimum blast load of 12 psi and 66 psi*msec, on 1 inch (25 mm) double pane glass and film attachment system.
15. GSA Rating of "3B" with minimum blast load of 4 psi and 29 psi*msec, on 1/4 inch (6 mm) pane glass without film attachment system.

16. GSA Rating of "3B" with minimum blast load of 8 psi and 44 psi*msec, on 1/4 inch (6 mm) single pane glass and film attachment system.
17. GSA Rating of "3B" with minimum blast load of 15 psi and 59 psi*msec, on 1 inch (25 mm) double pane glass without film attachment system.
18. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 5 psi and 32 psi*msec, on 1/4 inch (6 mm) single pane glass and film attachment system.
19. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 5 psi and 30 psi*msec, on 1 inch (25 mm) double pane glass and film attachment system.

C. Impact Resistance and Pressure Cycling:
1. ASTM E1996 / ASTM E1886: Small Missile "A", +/- 80 psf Design Pressure.
2. ASTM E1996 / ASTM E1886: Large Missile "C", +/- 75 psf Design Pressure
3. ASTM E1996 / ASTM E1886: Small Missile "A", +/- 70 psf Design Pressure
4. ASTM E1996 / ASTM E1886: Small Missile "A", +/- 60 psf Design Pressure
5. ASTM E1996 / ASTM E1886: Large Missile "C", +/- 60 psf Design Pressure

D. Tear Resistance:
1. Minimum Graves Area Tear Strength of 1,000 lbs% as measured on coated film product, without liner, per ASTM D1004.
2. Minimum Graves Area Tear Strength of 1,200 lbs% as measured on coated film product, without liner, per ASTM D1004.
3. Minimum Graves Area Tear Strength of 1,100 lbs% as measured on coated film product, without liner, per ASTM D1004.

E. Adhesion to Glass:
1. Minimum 8 lbs/in peel strength per ASTM D3330 (Method A).
2. Minimum 6 lbs/in peel strength per ASTM D3330 (Method A).
3. Minimum 6 lbs/in peel strength per ASTM D3330 (Method A).
4. Nominal 4 lbs/in peel strength per ASTM D3330 (Method A).
5. Nominal 5 lbs/in peel strength per ASTM D3330 (Method A).
6. Minimum 2 lbs/in peel strength per ASTM D3330 (Method A).
7. Nominal 4 lbs/in peel strength per ASTM D3330 (Method A).
8. Nominal 4 lbs/in peel strength per ASTM D3330 (Method A).
9. Nominal 5 lbs/in peel strength per ASTM D3330 (Method A).
10. Minimum 3 lbs/in peel strength per ASTM D3330 (Method A).
11. Nominal 1 lbs/in peel strength per ASTM D3330 (Method A).

F. Flammability: Surface burning characteristics when tested in accordance ASTM E 84, demonstrating film applied to glass rated Class A for Interior Use:
1. Flame Spread Index: no greater than 25.
2. Smoke Developed Index: no greater than 55.

G. UV Light Rejection:
1. Minimum of 99.9% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.
2. Minimum of 99.9% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.
3. Minimum of 99% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.
4. Minimum of 99.9% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass.
5. Minimum of 99% UV light rejection (300 - 380 nm), per ASTM E903, as determined with film applied on 1/4 inch clear glass

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Manufacturer's current technical literature on each product to be used, including:
   1. Manufacturer's Data Sheets.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. 3rd Party Test Report Submittal Requirements. Submit the following 3rd Party test reports indicating compliance with the test values listed in this section.
   1. Flammability Testing, ASTM E84.
   2. Film Properties Testing, ASTM D882.
   3. Abrasion Resistance Testing, ASTM D1044.
   4. Peel Strength Testing, ASTM D3330.
   5. Tear Resistance Testing, ASTM D1004.
   6. Puncture Strength Testing, ASTM D4830.
   7. Safety Glazing Impact Testing, ANSI Z97.1 and/or 16 CFR 1201.
   8. Burglary Resistance Glazing, UL 972
   9. Safety Glazing Impact Testing, ANSI Z97.1 and 16 CFR 1201.
   10. Impact Resistance and Pressure Cycling, ASTM E1886 and ASTM E1996.
   11. Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003.

D. Other Product Submittals:
   1. Manufacturer's summary of 3rd Party Blast Hazard Mitigation Testing, ASTM F1642 / F2912 and/or GSA-TS01-2003
   2. 3rd Party test reports from Forced Entry Resistance evaluations.

E. Verification Samples: For each film specified, two samples representing actual film color and pattern.

F. Performance Submittals: Provide laboratory data of emissivity and calculated window U-Factors for various outdoor temperatures based upon established calculation procedure defined by the ASHRAE Handbook of Fundamentals, Chapter 29, or Lawrence Berkeley Laboratory Window 5.2 Computer Program.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
   1. Provide documentation that the adhesive used on the specified film is a Pressure Sensitive Adhesive (PSA).

B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
   1. Provide documentation that the installer is authorized by the Manufacturer to perform Work specified in this section.
   2. Provide a commercial building reference list of 5 properties where the installer has applied window film. This list will include the following information:
      a. Name of building.
      b. The name and telephone number of a management contact.
      c. Type of glass.

d. Type of film and/or film attachment system.
e. Amount of film and/or film attachment system installed.
f. Date of completion.

3. Provide a Glass Stress Analysis of the existing glass and proposed glass/film combination as recommended by the film manufacturer.
4. Provide an EFilm application analysis to determine available energy cost reduction and savings.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Follow Manufacturer's instructions for storage and handling.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of any hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 WARRANTY

A. At project closeout, provide to Owner's Representative an executed current copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

B. In order to validate warranty, installation must be performed by an Authorized 3M dealer. Verification of Authorized 3M dealer can be confirmed by submission of active 3M dealer code number.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: 3M Commercial Solutions, which is located at: 3M Center Bldg. 220-12-E-04; St. Paul, MN 55144-1000; Toll Free Tel: 888-650-3497; Tel: 651-737-1081; Fax: 651 737 8241; Email: request info (tdjohnson3@mmm.com).|
1. Area authorized 3M Dealer: Layr: Tel: 888-888-8000; Email: info@layr.com; Web: www.layr.com

B. Requests for substitutions will be considered in accordance with provisions of Section 012500 - WOOD I-JOISTS.

2.02 CLEAR MICROLAYERED SAFETY AND SECURITY WINDOW FILM

A. 3M Scotchshield Ultra S600 Safety and Security Window Film. Optically clear microlayered polyester film, nominally 6 mils (0.006 inch) thick, with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is clear and does not contain dyed polyester. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film is microlayered with both plastic and ductile polyester layers for tear resistance.
   1. Physical / Mechanical Performance Properties (nominal):
      a. Film Color: Clear.
      b. Film Thickness (excluding coatings or adhesive liner): Nominal 6 mils
      c. Tensile Strength (ASTM D882):
         1) Base Film: 32,000 psi (MD) / 32,000 psi (TD).
         2) Coated Film: 32,000 psi (MD) / 32,000 psi (TD).
      d. Break Strength (ASTM D882):
         1) Base Film: 190 lb/in (MD) / 190 lb/in (TD).
         2) Coated Film: 210 lb/in (MD) / 210 lb/in (TD).
      e. Percent Elongation at Break (ASTM D882):
         1) Base Film: 110 % (MD) / 100 % (TD).
         2) Coated Film: 136 % (MD) / 115 % (TD).
      f. Yield Strength:
         1) Base Film: 12,000 psi (MD).
         2) Coated Film: 15,000 psi (MD).
      g. Percent Elongation at Yield (ASTM D882):
         1) Base Film: 7% (MD).
         2) Coated Film: 9% (MD).
      h. Graves Tear Resistance (ASTM D1004):
         1) Maximum Force (lbs):
            (a) Base Film: 28 (MD) / 28 (TD).
            (b) Coated Film: 28 (MD) / 28 (TD).
         2) Maximum Extension (in):
            (a) Base Film: 0.45 (MD) / 0.65 (TD).
            (b) Coated Film: 0.55 (MD) / 0.55 (TD).
         3) Graves Area Tear Resistance (lbs%):
            (a) Base Film: 900 (MD) / 1,200 (TD).
            (b) Coated Film: 900 (MD) / 1,100 (TD).
      i. Puncture Propagation Tear Resistance (ASTM D2582):
         1) Coated Film: 6 lbf (MD) / 7 lbf (TD).
      j. Puncture Strength (ASTM D4830):
         1) Coated Film: 140 lbf.
   2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   3. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.
   4. Identification: Labeled as to Manufacturer as listed in this Section.
   5. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass.
      a. Visible Light Transmission (ASTM E 903): 87 percent.
      b. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
   6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
      a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
      b. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
   7. Impact Resistance and Pressure Cycling: Film shall pass impact of Small Missile "A" and withstand subsequent pressure cycling (per ASTM E 1996 and ASTM E1886E 1886) at +/

80 psf Design Pressure with use of 3M Impact Protection Adhesive. Film applied to 3/16 inch (4.8 mm) tempered glass.

8. Blast Hazard Mitigation:
9. Independent testing with results from high explosive arena blast or shock tube testing:
    a. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 44 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Profile Attachment system.
    b. GSA Rating of "2"/ ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Profile Attachment system
    c. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Adhesive Attachment system
    d. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Adhesive Attachment system
    e. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 8 psi and 60 psi*msec blast impulse, on 1 inch (25.4 mm) annealed double pane glass and 3M Impact Protection Profile Attachment system
    f. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 8 psi and 60 psi*msec blast impulse, on 1 inch (25.4 mm) annealed double pane glass and 3M Impact Protection Adhesive Attachment system
    g. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass, daylight applied film (no attachment)
    h. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast pressure of 7 psi and 43 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass, daylight applied film (no attachment)
    i. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 1 inch (25.4 mm) annealed double pane glass, daylight applied film (no attachment)
    j. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast pressure of 12 psi and 70 psi*msec blast impulse, on 1 inch (25.4 mm) tempered double pane glass, daylight applied film (no attachment)
10. Forced Entry Resistance: Product shall have been evaluated for time to resist complete body passage by a qualified 3rd Party test lab.

B. 3M Scotchshield Ultra S800 Safety and Security Window Film. Optically clear microlayered polyester film, nominally 8 mils (0.008 inch) thick, with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is clear and does not contain dyed polyester. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film is microlayered with both plastic and ductile polyester layers for tear resistance.
    1. Physical / Mechanical Performance Properties (nominal):
        a. Film Color: Clear.
        b. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils
        c. Tensile Strength (ASTM D882):
            1) Base Film: 32,000 psi (MD) / 32,000 psi (TD).
            2) Coated Film: 32,000 psi (MD) / 32,000 psi (TD).
        d. Break Strength (ASTM D882):
            1) Base Film: 250 lb/in (MD) / 250 lb/in (TD).
            2) Coated Film: 245 lb/in (MD) / 265 lb/in (TD).
        e. Percent Elongation at Break (ASTM D882):
            1) Base Film: 115 % (MD) / 115 % (TD).
            2) Coated Film: 132 % (MD) / 130 % (TD).

f. Yield Strength:
   1) Base Film: 12,000 psi (MD).
   2) Coated Film: 15,000 psi (MD).
g. Percent Elongation at Yield (ASTM D882):
   1) Base Film: 7% (MD).
   2) Coated Film: 9% (MD).
h. Graves Tear Resistance (ASTM D1004):
   1) Maximum Force (lbs):
      (a) Base Film: 40 (MD) / 40 (TD).
      (b) Coated Film: 40 (MD) / 40 (TD).
   2) Maximum Extension (in):
      (a) Base Film: 0.45 (MD) / 0.65 (TD).
      (b) Coated Film: 0.50 (MD) / 0.57 (TD).
   3) Graves Area Tear Resistance (lbs%):
      (a) Base Film: 1,100 (MD) / 1,300 (TD).
      (b) Coated Film: 1,100 (MD) / 1,300 (TD).
i. Puncture Propagation Tear Resistance (ASTM D2582):
   1) Coated Film: 9 lbf (MD) / 10 lbf (TD).
j. Puncture Strength (ASTM D4830):
   1) Material Properties (as supplied).
   2) Coated Film: 185 lbf.

2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass.
   a. Visible Light Transmission (ASTM E 903): 87 percent.
   b. Visible Reflection (ASTM E 903): Not more than 10 percent.
   c. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
   d. Solar Heat Gain Coefficient (ASTM E 903): 0.79
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
   a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
   b. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
7. Impact Resistance and Pressure Cycling: Film shall pass impact of Large Missile "C" and withstand subsequent pressure cycling (per ASTM E1996 and ASTM E1886) at +/ 75 psf Design Pressure with use of 3M Impact Protection Adhesive. Film applied to 1/4-inch tempered glass.
8. Blast Hazard Mitigation:
   a. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 44 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Profile Attachment system
   b. GSA Rating of "2"/ ASTM F1642 "Minimal Hazard" with blast pressure of 7 psi and 43 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Profile Attachment system
   c. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 9 psi and 62 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Adhesive Attachment system
   d. GSA Rating of "2" / ASTM F1642 "No Hazard" with blast pressure of 9 psi and 63 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Adhesive Attachment system
   e. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 9 psi and 60 psi*msec blast impulse, on 1 inch (25 mm) annealed double pane glass and 3M Impact Protection Profile Attachment system

f. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 10 psi and 89 psi*msec blast impulse, on 1 inch (25 mm) annealed double pane glass and 3M Impact Protection Adhesive Attachment system
g. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass, daylight applied film (no attachment)
h. GSA Rating of "3B" / ASTM F1642 "Very Low Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass, daylight applied film (no attachment)
i. GSA Rating of "3B" / ASTM F1642 "Low Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 1 inch (25 mm) annealed double pane glass, daylight applied film (no attachment)

9. Forced Entry Resistance: Product shall have been evaluated for time to resist complete body passage by a qualified 3rd Party test lab.

2.03 MICROLAYERED SAFETY AND SECURITY WINDOW FILM WITH SUN CONTROL

A. 3M Scotchshield Ultra Prestige S70: Optically clear micro-layered polyester, laminated to an optically clear multi-layered polyester film containing at least 220 layers with a pressure sensitive adhesive on one side and durable acrylic abrasion resistant coating on the other side. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. Films contain no metals, but so contain infrared-absorbing carbon, metal oxide particles, or both.
   1. Physical / Mechanical Performance Properties:
      a. Film Color: Virtually clear with at least 220 layers.
      b. Thickness: Nominal 8.0 mils
      c. Tensile Strength (ASTM D 882): 24,000 psi (MD) / 26,000 psi (TD)
      d. Break Strength (ASTM D 882): 200 lbs/in (MD) / 215 lbs/in (TD)
      e. Percent Elongation at Break (ASTM D882): 104% (MD) / 118% (TD)
      f. Yield Strength (ASTM D882): 16,000 psi (MD)
      g. Percent Elongation at Yield (ASTM D882): 8% (MD)
      h. Graves Tear Resistance (AASTM D1004):
         1) Maximum Force: 35 lbs (MD) / 36 lbs (TD)
         2) Maximum Strain: 56% (MD) / 50% (TD)
         3) Graves Area Tear Resistance: 1,100 lbs% (MD) / 1,100 lbs% (TD)
      i. Puncture Propagation Tear (ASTM D 2582): 10 lbf
   2. Solar Performance Properties: Film applied to 1/4 Inch thick clear glass.
      a. Visible Light Transmission (ASTM E 903): 68 percent.
      b. Visible Reflection (ASTM E 903): Not more than 10 percent.
      c. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
      d. Solar Heat Gain Coefficient (ASTM E 903): 0.51
      e. Total Solar Energy Rejected: 50%
   3. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   4. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
   5. Identification: Labeled as to Manufacturer as listed in this Section.
   6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
      a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
   7. Impact Resistance and Pressure Cycling:
      a. Safety film component shall pass impact of Small Missile "A" and withstand subsequent pressure cycling (per ASTM E 1996 and E 1886) at +/- 80 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system.
   8. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.

a. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 6 psi and 45 psi*msec, on 1/4 inch (6 mm) single pane tempered glass and 3M Impact Protection Adhesive film attachment system.
b. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 9 psi and 60 psi*msec, on 1 inch (25 mm) double pane tempered glass and 3M Impact Protection Adhesive film attachment system.

B. 3M Scotchshield Ultra Prestige S50: Optically clear micro-layered polyester, laminated to an optically clear multi-layered polyester film containing at least 220 layers with a pressure sensitive adhesive on one side and durable acrylic abrasion resistant coating on the other side. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. Films contain no metals, but so contain infrared-absorbing carbon, metal oxide particles, or both.
1. Physical / Mechanical Performance Properties:
a. Film Color: Lightly tinted with at least 220 layers.
b. Thickness: Nominal 8.0 mils
c. Tensile Strength (ASTM D 882): 25,000 psi (MD) / 26,000 psi (TD)
d. Break Strength (ASTM D 882): 210 lbs/in (MD) / 220 lbs/in (TD)
e. Percent Elongation at Break (ASTM D882): 111% (MD) / 102% (TD)
f. Yield Strength (ASTM D882): 16,000 psi (MD)
g. Percent Elongation at Yield (ASTM D882): 8% (MD)
h. Graves Tear Resistance (ASTM D1004):
1) Maximum Force: 36 lbs (MD) / 36 lbs (TD)
2) Maximum Strain: 50% (MD) / 50% (TD)
3) Graves Area Tear Resistance: 1,100 lbs% (MD) / 1,100 lbs% (TD)
i. Puncture Propagation Tear (ASTM D 2582): 10 lbf
2. Solar Performance Properties: Film applied to 1/4 Inch thick clear glass.
a. Visible Light Transmission (ASTM E 903): 48 percent.
b. Visible Reflection (ASTM E 903): Not more than 10 percent.
c. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
d. Solar Heat Gain Coefficient (ASTM E 903): 0.44
e. Total Solar Energy Rejected: 56%
3. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
4. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
5. Identification: Labeled as to Manufacturer as listed in this Section.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
7. Impact Resistance and Pressure Cycling:
a. Safety film component shall pass impact of Small Missile "A" and withstand subsequent pressure cycling (per ASTM E 1996 and E 1886) at +/- 80 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system.
8. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.
a. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 6 psi and 45 psi*msec, on 1/4 inch (6 mm) single pane tempered glass and 3M Impact Protection Adhesive film attachment system.
b. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 9 psi and 60 psi*msec, on 1 inch (25 mm) double pane tempered glass and 3M Impact Protection Adhesive film attachment system.

C. 3M Scotchshield Ultra Night Vision S25: Optically clear polyester film comprised of co-extruded micro-layers, laminated to a metalized polyester film. Additional film layer is added for color and performance, with a durable abrasion resistant coating over one surface and a pressure

sensitive adhesive on the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film color is derived from the metal coating and the product will not contain dyed polyester.

1. Physical / Mechanical Performance Properties:
    a. Film Color: Moderately tinted.
    b. Thickness: Nominal 8.0 mils
    c. Tensile Strength (ASTM D 882): 28,000 psi (MD) / 27,000 psi (TD)
    d. Break Strength (ASTM D 882): 235 lbs/in (MD) / 230 lbs/in (TD)
    e. Percent Elongation at Break (ASTM D882): 120% (MD) / 85% (TD)
    f. Yield Strength (ASTM D882): 17,000 psi (MD)
    g. Percent Elongation at Yield (ASTM D882): 8% (MD)
    h. Graves Tear Resistance (ASTM D1004):
        1) Maximum Force: 37 lbs (MD) / 38 lbs (TD)
        2) Maximum Strain: 49% (MD) / 46% (TD)
        3) Graves Area Tear Resistance: 1,100 lbs% (MD) / 900 lbs% TD)
    i. Puncture Propagation Tear (ASTM D 2582): 10 lbf
2. Solar Performance Properties: Film applied to 1/4 Inch thick clear glass.
    a. Visible Light Transmission (ASTM E 903): 24 percent.
    b. Visible Reflection (ASTM E 903): Not more than 20 percent exterior / 7% interior.
    c. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
    d. Solar Heat Gain Coefficient (ASTM E 903): 0.40
    e. Total Solar Energy Rejected: 60%
3. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
4. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
5. Identification: Labeled as to Manufacturer as listed in this Section.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
    a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
    b. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
7. Impact and Pressure Cycling:
    a. Safety film component shall pass impact of Small Missile "A" and withstand subsequent pressure cycling (per ASTM E 1996 and E 1886) at +/- 80 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system.
8. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.
    a. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 6 psi and 43 psi*msec, on 1/4 inch (6 mm) single pane annealed glass and 3M Impact Protection Adhesive film attachment system.
    b. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 6 psi and 45 psi*msec, on 1/4 inch (6 mm) single pane tempered glass and 3M Impact Protection Adhesive film attachment system.
    c. GSA Rating of "3B" / ASTM F1642 "Minimal Hazard" with minimum blast load of 5 psi and 32 psi*msec, on 1/4 inch (6 mm) single pane tempered glass and 3M Impact Protection Profile film attachment system.
    d. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 5 psi and 35 psi*msec, on 1 inch (25 mm) double pane annealed glass and 3M Impact Protection Profile film attachment system
    e. GSA Rating of "2" / ASTM F1642 "No Hazard" with minimum blast load of 9 psi and 61 psi*msec, on 1 inch (25 mm) double pane tempered glass and 3M Impact Protection Adhesive film attachment system

2.04 CLEAR SAFETY AND SECURITY WINDOW FILM

A. 3M Safety S40 (SH4CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass.
   1. Physical / Mechanical Performance Properties:
      a. Film Color: Clear.
      b. Thickness: Nominal 4.0 mils
      c. Tensile Strength (ASTM D 882): 25,000 psi.
      d. Elongation: 130 percent.
      e. Break Strength (ASTM D 882): 100 lbs/in
   2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
   4. Identification: Labeled as to Manufacturer as listed in this Section.
   5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
      a. Visible Light Transmission (ASTM E 903): 87 percent.
      b. Ultraviolet Transmission (ASTM E 903): Less than 1 percent.
   6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
      a. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).
      b. Safety Rating (ANSI Z97.1): Class B, Unlimited Size.

B. 3M Safety S70 (SH7CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
   1. Physical / Mechanical Performance Properties:
      a. Film Color: Clear.
      b. Thickness: Nominal 7.0 mils
      c. Tensile Strength (ASTM D 882): 25,000 psi.
      d. Break Strength (ASTM D 882): 175 lbs/in.
   2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
   4. Identification: Labeled as to Manufacturer as listed in this Section.
   5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
      a. Visible Light Transmission (ASTM E 903): 87 percent.
      b. Ultraviolet Transmission (ASTM E 903): Less than 1 percent.
   6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
      a. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).
   7. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.
      a. GSA Rating of "3B" with minimum blast load of 4 psi and 28 psi*msec, on 1/4 inch single pane annealed glass and 3M Impact Protection Adhesive film attachment system.
      b. GSA Rating of "3B" with minimum blast load of 10 psi and 89 psi*msec, on 1 inch (25 mm) double pane annealed glass and 3M Impact Protection Adhesive film attachment system.

C. 3M Safety S80 (SH8CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical

bond, to the glass. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.

1. Physical / Mechanical Performance Properties:
    a. Film Color: Clear.
    b. Thickness: Nominal 8 mils.
    c. Tensile Strength (ASTM D 882): 25,000 psi.
    d. Break Strength (ASTM D 882): 200 lbs/in
2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
    a. Visible Light Transmission (ASTM E 903): 87 percent.
    b. Ultraviolet Transmission (ASTM E 903): Less than 1 percent.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
    a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
    b. Safety Rating (ANSI Z97.1): Class A, Unlimited Size.
7. Blast Hazard Mitigation:
    a. GSA Rating of "3B" / ASTM F1642 "Minimal Hazard" with minimum blast load of 6 psi and 41 psi*msec, on 1/4 inch (6 mm) single pane annealed glass and 3M Impact Protection Adhesive film attachment system.
    b. GSA Rating of "3B" with minimum blast load of 7 psi and 41 psi*msec, on 1/4 inch single pane annealed glass and 3M Impact Protection Profile film attachment system.
    c. GSA Rating of "3B" with minimum blast load of 4 psi and 29 psi*msec, on 1/4 inch single pane annealed or tempered glass without use of film attachment system.
    d. GSA Rating of "2" with minimum blast load of 12 psi and 66 psi*msec, on 1 inch double pane annealed glass and 3M Impact Protection Adhesive film attachment system.
    e. GSA Rating of "3B" with minimum blast load of 14 psi and 63 psi*msec, on 1 inch double pane annealed glass and 3M Impact Protection Profile film attachment system.

D. 3M Safety S140 (SH14CLARL): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.

1. Physical / Mechanical Performance Properties:
    a. Film Color: Clear.
    b. Thickness: Nominal 14 mils
    c. Tensile Strength (ASTM D 882): 25,000 psi.
    d. Break Strength (ASTM D 882) (Per Inch Width): 350 lbs.
2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
    a. Visible Light Transmission (ASTM E 903): 85 percent.
    b. Ultraviolet Transmission (ASTM E 903): Less than 1 percent.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
    a. Safety Rating (CPSC 16 CFR, Part 1201): Category II (400 ft.-lbs).
7. Impact Resistance and Pressure Cycling:

a. Film shall pass impact of Medium Large Missile "C" and withstand subsequent pressure cycling (per ASTM E 1996 and E 1886) at +/- 50 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system.

8. Blast Hazard Mitigation: Independent testing with results from high explosive arena blast testing.
   a. GSA Rating of "3B" with minimum blast load of 8 psi and 44 psi*msec, on 1/4 inch single pane annealed glass and 3M Impact Protection Profile film attachment system.
   b. GSA level 3B rating with minimum blast load of 15 psi overpressure and 58 psi*msec blast impulse on 1 inch double pane annealed glass without use of film attachment system.
9. Forced Entry Protection: Independent lab testing according to UL 972 protocol (Multiple Impact Test).
   a. Annealed Glass (1/4 inch) - Pass
   b. Tempered Glass (1/4 inch) - Pass

E. 3M Safety Exterior S20: Optically clear polyester film with an exterior durable abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
1. Physical / Mechanical Performance Properties:
   a. Film Color: Clear.
   b. Thickness: Nominal 2 mils
   c. Tensile Strength (ASTM D 882): 25,000 psi.
   d. Elongation: 88 percent.
   e. Break Strength (ASTM D 882): 50 lbs/in
2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
   a. Visible Light Transmission (ASTM E 903): 88 percent.
   b. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
   a. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).
   b. Safety Rating (ANSI Z97.1): Class B, Unlimited Size.

F. 3M Safety Exterior S40. Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.
1. Physical / Mechanical Performance Properties:
   a. Film Color: Clear.
   b. Thickness: Nominal 4 mils
   c. Tensile Strength (ASTM D 882): 25,000 psi.
   d. Break Strength (ASTM D 882): 100 lbs/in.
2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
   a. Visible Light Transmission (ASTM E 903): 89 percent.
   b. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
   a. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).

G. 3M Safety Exterior S70. Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other.

1. Physical / Mechanical Performance Properties:
   a. Film Color: Clear.
   b. Thickness: Nominal 7 mils
   c. Tensile Strength (ASTM D 882): 25,000 psi.
   d. Break Strength (ASTM D 882): 140 lbs/in.
2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
   a. Visible Light Transmission (ASTM E 903): 88 percent.
   b. Ultraviolet Transmission (ASTM E 903): Less than 0.5 percent.
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
   a. Safety Rating (CPSC 16 CFR, Part 1201): Category I (150 ft.-lbs).

2.05 SAFETY AND SECURITY WINDOW FILM WITH SUN CONTROL

A. 3M Safety Neutral S35. Dual reflective polyester film, nominally 8 mils (0.008") thick, with a durable abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is comprised of an optically clear safety film laminated to a metalized film layer for reflective and sun control properties. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass.
   1. Physical / Mechanical Performance Properties (nominal):
      a. Film Color: Neutral
      b. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils
      c. Tensile Strength 33,000 psi (MD) / 23,000 psi (TD)
      d. Break Strength: 170 lb/in (MD) / 280 lb/in (TD)
      e. Percent Elongation at Break: 100 % (MD) / 80 % (TD)
      f. Yield Strength: 23,000 psi
      g. Percent Elongation at Yield: 80%
   2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   3. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.
   4. Identification: Labeled as to Manufacturer as listed in this Section.
   5. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass (NFRC 100/200).
      a. Visible Light Transmission: 39%
      b. Visible Reflection: 23% exterior / 13% interior
      c. Ultraviolet Transmission: Not more than 1%.
      d. Solar Heat Gain Coefficient: 0.43
   6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
      a. Safety Rating (CPSC 16 CFR, Part 1201): Category 2 (400 ft.-lbs).
      b. Safety Rating (ANSI Z97.1): Class A, Unlimited (400 ft.-lbs).
   7. Impact Resistance and Pressure Cycling
      a. Film shall pass impact of Large Missile "C" and withstand subsequent pressure cycling (per ASTM E1996 and ASTM E1886) at +/- 60 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system. Tested on 1/4 inch (6 mm) tempered glass.
   8. Blast Hazard Mitigation:
      a. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Profile Attachment system

b. GSA Rating of "2"/ ASTM F1642 "Minimal Hazard" with blast pressure of 6 psi and 42 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Adhesive Attachment system
c. GSA Rating of "2" / ASTM F1642 "No Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Adhesive Attachment system
d. GSA Rating of "2" / ASTM F1642 "No Hazard" with blast pressure of 6 psi and 42 psi*msec blast impulse, on 1 inch (25 mm) double pane tempered glass and 3M Impact Protection Adhesive Attachment system

B. 3M Safety Silver S20. Highly reflective polyester film, nominally 8 mils (0.008") thick, with a durable abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The film is comprised of an optically clear safety film laminated to a metalized film layer for reflective and sun control properties. The adhesive is pressure-activated, not water-activated, and forms a physical bond, not chemical bond, to the glass.
1. Physical / Mechanical Performance Properties (nominal):
a. Film Color: Silver reflective
b. Film Thickness (excluding coatings or adhesive liner): Nominal 8 mils
c. Tensile Strength: 20,000 psi (MD) / 30,000 psi (TD)
d. Break Strength: 160 lb/in (MD) / 247 lb/in (TD)
e. Percent Elongation at Break: 95 % (MD) / 76 % (TD)
f. Yield Strength: 15,000 psi
g. Percent Elongation at Yield: 7%
2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
3. Variation in Total Transmission across the width: Less than 2 percent over the average at any portion along the length.
4. Identification: Labeled as to Manufacturer as listed in this Section.
5. Solar Performance Properties: Film applied to 1/4 inch (6 mm) thick clear glass (NFRC 100/200).
a. Visible Light Transmission: 18%
b. Visible Reflection: 61%
c. Ultraviolet Transmission: Not more than 1%.
d. Solar Heat Gain Coefficient: 0.25
6. Impact Resistance for Safety Glazing: Tested on 1/4 inch (6 mm) annealed glass.
a. Safety Rating (CPSC 16 CFR, Part 1201): Category 2 (400 ft-lbs).
b. Safety Rating (ANSI Z97.1): Class A, Unlimited (400 ft-lbs).
7. Impact Resistance and Pressure Cycling
a. Film shall pass impact of Small Missile "A" and withstand subsequent pressure cycling (per ASTM E1996 and ASTM E1886) at +/- 60 psf Design Pressure with use of 3M Impact Protection Adhesive attachment system. Tested on 1/4 inch (6 mm) tempered glass.
8. Blast Hazard Mitigation:
a. GSA Rating of "2" / ASTM F1642 "Minimal Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Profile Attachment system
b. GSA Rating of "2"/ ASTM F1642 "Minimal Hazard" with blast pressure of 6 psi and 42 psi*msec blast impulse, on 1/4 inch (6 mm) annealed single pane glass and 3M Impact Protection Adhesive Attachment system
c. GSA Rating of "2" / ASTM F1642 "No Hazard" with blast pressure of 4 psi and 28 psi*msec blast impulse, on 1/4 inch (6 mm) tempered single pane glass and 3M Impact Protection Adhesive Attachment system
d. GSA Rating of "2" / ASTM F1642 "No Hazard" with blast pressure of 6 psi and 42 psi*msec blast impulse, on 1 inch (25 mm) double pane tempered glass and 3M Impact Protection Adhesive Attachment system

2.06 ANTI-GRAFFITI WINDOW FILM

A. 3M Anti-Graffiti 4 (AG-4): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
   1. Physical / Mechanical Performance Properties:
      a. Film Color: Clear.
      b. Thickness: Nominal 4.0 mils
      c. Tensile Strength (ASTM D 882): 25,000 psi.
      d. Break Strength (ASTM D 882) (Per Inch Width): 136 lbs.
      e. Elongation at Break (ASTM D 882): > 100 percent.
      f. Peel Strength: 1 lb/inch.
      g. Puncture Strength (ASTM D 4830): 90 lbs.
      h. Abrasion Resistance (ASTM D1044): < 2 percent increase in haze.
   2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
   4. Identification: Labeled as to Manufacturer as listed in this Section.
   5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
      a. Visible Light Transmission (ASTM E 903): 81 percent.
      b. Ultraviolet Transmission (ASTM E 903): Less than 1 percent.

B. 3M Anti-Graffiti 6 (AG-6): Optically clear polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive over the other. The film may be laminated to other clear polyester film layers to achieve the desired thickness of the film.
   1. Physical / Mechanical Performance Properties:
      a. Film Color: Clear.
      b. Thickness: Nominal 6.0 mils
      c. Tensile Strength (ASTM D 882): 25,000 psi.
      d. Break Strength (ASTM D 882): 150 lbs/in
      e. Elongation at Break (ASTM D 882): > 100 percent.
      f. Peel Strength: 1 lb/inch.
      g. Puncture Strength (ASTM D 4830): 125 lbs.
      h. Abrasion Resistance (ASTM D 1044): < 2 percent increase in haze.
   2. Uniformity: No noticeable pin holes, streaks, thin spots, scratches, banding or other optical defects.
   3. Variation in Total Transmission across the Width: Less than 2 percent over the average at any portion along the length.
   4. Identification: Labeled as to Manufacturer as listed in this Section.
   5. Solar Performance Properties: Film applied to 1/4 Inch (6 mm) thick clear glass.
      a. Visible Light Transmission (ASTM E 903): 87 percent.
      b. Ultraviolet Transmission (ASTM E 903): Less than 1 percent.

2.07 3M IMPACT PROTECTION FILM ATTACHMENT SYSTEMS

A. 3M Impact Protection Adhesive (IPA): Weatherable, UV-resistant, moisture curable structural sealant wet glaze.
   1. Color:
      a. Black.
      b. White.
   2. Material Properties (as supplied):
      a. Typical Cure Time: 3 - 7 days (25 degrees C, 50% RH)
      b. Full Adhesion: 7 - 14 days

c. Tack-Free Time (ASTM D 5895): 21 minutes (25 degrees C, 50% RH)
d. Flow, Sag or Slump (ASTM D 2202): 0 inches
e. Specific Gravity: 1.4
f. Working Time: 10 - 20 minutes (25 degrees C, 50% RH)
g. VOC Content: 16 g/L

3. Material Properties (as cured - 21 days at 25 degrees C, 50% RH):
   a. Ultimate Tensile Strength (ASTM D412): 380 psi (2.62 MPa)
   b. Ultimate Elongation (ASTM D412): 640 psi
   c. Durometer Hardness, Shore A (ASTM D2240): 38-39 points
   d. Tear Strength, Die B (ASTM D624): 72 ppi
4. Uniformity: Product shall have uniform consistency and appearance, with no clumping.
5. Impact Resistance and Pressure Cycling:
   a. As part of a filmed glass system, film attachment shall demonstrate ability to withstand Medium Large Missile C and Small Missile A impact, with subsequent pressure cycling (per ASTM E 1996 and ASTM E 1886) at +/- 75 psf design pressure.
   b. As part of a filmed glass system, film attachment shall demonstrate ability withstand structural load requirements of ASTM E330 when tested at +/ 100 psf design pressure.
6. Blast Hazard Mitigation:
   a. GSA level "2" rating (minimal hazard) of "2" with minimum blast load of 11 psi overpressure and 55 psi*msec blast impulse.
   b. GSA level "3B" rating (low hazard) with minimum blast load of 10 psi overpressure and 89 psi*msec blast impulse.
   c. ASTM F1642 rating of "Low Hazard" with minimum blast load of 8 psi overpressure and 42 psi*msec blast impulse.

B. 3M Impact Protection Profile (IPP): Weatherable, flexible-mechanical style film attachment made of extruded rubber profile with two strips of double coated foam tape: one strip for bonding to applied film and the other strip for bonding to the window frame.
1. 3M Impact Protection Profile, BP-700.
   a. Total width: 1.0 inches.
   b. Tape width: 0.5 inches.
2. 3M Impact Protection Profile, BP-950.
   a. Total width: 1.3 inches.
   b. Tape width: 0.625 inches.
3. 3M Impact Protection Profile, BP-950 XL.
   a. Total width: 1.3 inches.
   b. Tape width: 0.38 inches.
4. Material Properties:
   a. Full Adhesion: 1 - 2 days (25 degrees C, 50% RH)
   b. Ultimate Tensile Strength (AASTM D412): > 20,500 psi
   c. Ultimate Elongation (ASTM D412): 400%
   d. Break Strength, Die B (ASTM D624): > 71 ppi
   e. Durometer Hardness, Shore A: (ASTM D2240): 70 pts
5. Uniformity: Product shall have uniform consistency and appearance.
6. Impact Resistance and Pressure Cycling:
   a. As part of a filmed glass system, film attachment shall demonstrate ability to withstand Small Missile A impact, with subsequent pressure cycling (per ASTMs E 1996 and E 1886) at +/- 50 psf design pressure.
7. Blast Hazard Mitigation:
   a. GSA level "2" rating (minimal hazard) with minimum blast load of 4 psi overpressure and 28 psi*msec blast impulse.
   b. GSA level "3B" rating (low hazard) with minimum blast load of 10 psi overpressure and 89 psi*msec blast impulse.

c. ASTM F1642 rating of "Low Hazard" with minimum blast load of 4 psi overpressure and 28 psi*msec blast impulse.

PART 3 EXECUTION

3.01 EXAMINATION

A. Film Examination:
1. If preparation of glass surfaces is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.
2. Glass surfaces receiving new film should first be examined to verify that they are free from defects and imperfections, which will affect the final appearance.
3. Do not proceed with installation until glass surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
4. Commencement of installation constitutes acceptance of conditions.

B. Impact Protection Adhesive Examination:
1. If application of window film is/was the responsibility of another installer, notification in writing shall be made of deviations from manufacturer's recommended installation tolerances and conditions.
2. Filmed glass surfaces receiving new attachment should first be examined to verify that they are free from defects and imperfections, and that the film edges extend sufficiently to the frame edges.
3. Do not proceed with installation until film and frame surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
4. Conduct an adhesion test to the frame surface may be conducted by applying a 4 - 6 inch long bead, approximately 0.5 - 1 inch in width, masking one side of the frame surface underneath the strip with tape. Allow the Impact Protection Adhesive to cure for 7 days and test adhesion by pulling up on the masked end and a 90 degree angle. If cohesive failure is observed (adhesive residue left behind on the frame surface), adhesion is acceptable; if adhesive failure is observed (clean peel from the frame), adhesion is unacceptable and product is not recommended.

C. Impact Protection Profile Examination:
1. If application of window film is/was the responsibility of another installer, notification in writing shall be made of deviations from manufacturer's recommended installation tolerances and conditions.
2. Windows and frames must be examined to ensure that they are fit to receive the Impact Protection Profile in a manner such that the two profile adhesive strips will be perpendicularly opposed to each other and that they will not contact glazing stops or frame gaskets without stretching the profile.
3. Filmed glass surfaces receiving new attachment should first be examined to verify that they are free from defects and imperfections, and that the film edges extend sufficiently to the frame edges.
4. Do not proceed with installation until film and frame surfaces have been properly prepared and deviations from manufacturer's recommended tolerances are corrected. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result under the project conditions.
5. Conduct an adhesion test to the frame surface may be conducted by applying a 4 - 6 inch long strip on the frame surface, using the sufficient pressure to achieve good adhesive wet-out. Allow the Impact Protection Profile to cure for 1-2 days and test adhesion by

removing the test strip. If cohesive failure is observed (adhesive residue left behind on the frame surface), adhesion is acceptable; if adhesive failure is observed (clean peel from the frame), adhesion is unacceptable and product is either not recommended, or an adhesion promoter, such as 3M Primer 94, must be used.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Refer to Manufacturer's installation instructions for methods of preparation for Impact Protection Adhesive or Impact Protection Profile film attachment systems.

3.03 INSTALLATION

A. Film Installation:
   1. Install in accordance with manufacturer's instructions.
   2. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant. Use new blade tips after 3 to 4 cuts.
   3. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
   4. Apply film to glass and lightly spray film with slip solution.
   5. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
   6. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
   7. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

B. Impact Protection Adhesive Installation:
   1. The film attachment system shall be applied according to the specifications of the Manufacturer by an Authorized Dealer/Applicator. Refer to 3M publication, 70-0709-0322-7, 3M Impact Protection Adhesive Attachment System Installation Instructions.
      a. For blast hazard mitigation: minimum 1/2 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).
      b. For impact resistance and building envelope protection: minimum 3/8 inch bead overlap on both frame and film (excluding glazing stops or compression gaskets).
   2. To ensure a straight and consistent bead width is achieved, masking tape may be applied to film and frame surfaces prior to application.
   3. With prior approval of the building owner or property manager, existing compression gaskets may be partially removed or trimmed to allow for a thinner bead and stronger anchorage. If removing the gaskets, sections shall be trimmed approximately 3 inches in length and inserted with appropriate spacing along all sides of the window to help secure the glazing during application and curing of the Impact Protection Adhesive.
   4. The Impact Protection Adhesive shall be dispensed with a caulk gun with nozzle opening diameter sized to match the approximate size of the desired bead width.
   5. A plastic putty knife or other tool with a clean straight edge shall be used to trowel and smooth out the adhesive. The completed adhesive bead shall be relatively triangular in shape.
   6. Any masking tape used shall be carefully removed within 10 minutes after applying the wet glaze.

C. Impact Protection Profile Installation:

1. The film attachment system shall be applied according to the specifications of the Manufacturer by an Authorized Dealer/Applicator trained to install 3M Impact Protection Profile. Refer to 3M publication, 3M Impact Protection Profile Installation Systems Instructions.
2. Each profile piece must span continuously to both sides of the window, within 1/8 inch to the frame edge. Splicing the profile between frame edges is prohibited.
3. Profile must be aligned and applied by 3M recommended or approved methods and tools to ensure a quality installation.
4. Corner joints must be fabricated by 3M recommended and approved methods. No part of the profile adhesive shall make contact with an adjacent profile.
5. Sufficient pressure must be evenly applied along the entire length of the profile to ensure full adhesion from both adhesive strips. A roller tool is required to minimize entrapment of air in the adhesive.

3.04 CLEANING AND PROTECTION

A. Remove left over material and debris from Work area. Use necessary means to protect film before, during, and after installation.

B. Touch-up, repair or replace damaged products before Substantial Completion.

C. After application of film, wash film using common window cleaning solutions, including ammonia solutions, 30 days after application. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

END OF SECTION

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. Fixed louvers, frames and accessories.

1.03 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).

D. Drainable-Blade Louver ASTM E330/E330M: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
   2. Show mullion profiles and locations.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural and seismic performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements

B. Windborne-debris-impact-resistance test reports.

1.06 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural and seismic performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
   2. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa), acting inward or outward.

C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade shall pass enhanced-protection, large-missile testing requirements in ASTM E1996 for Wind Zone 3 when tested according to ASTM E1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.

D. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

G. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Airolite Company, LLC (The):
b. Arrow United Industries; a division of Mestek, Inc
c. Construction Specialties, Inc
d. Greenheck Fan Corporation
e. Nystrom, Inc.
f. Ruskin Company; Tomkins PLC.

2. Louver Depth: 4 inches (K6744X).
3. Blade Angle: 35 degrees.
4. Drainable Blades (ASTM E330/E330M)
5. Frame and Blade Nominal Thickness: Not less than 0.081 inch.
6. Louver Performance Ratings:
   a. Free Area: Not less than 8.92 (K6744X) []sq. ft. for 48-inch wide by 48-inch high louver.
   b. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area intake velocity.
   c. Wind-Driven Rain Performance: Not less than 95 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 989 fpm (K6744X).
   d. Maximum Qualified Wind design Load: +/- 200 PSF
7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

A. General: Provide screen as manufactured by the Louver manufacturer on the interior face of each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Provide and install Bird screening except where Insect screening is indicated.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Same finish as louver frames to which louver screens are attached.
   3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Stainless steel, 18 by 18 mesh, 0.009-inch wire.

2.05 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5, T-52, or T6.

B. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.06 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
   2. Horizontal Mullions: Provide horizontal mullions at joints where indicated.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
   1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
   2. Exterior Corners: Prefabricated corner units with mitered and welded blades and with mullions at corners.

G. Provide subsills made of same material as louvers or extended sills for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.07 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. High-Performance Organic Finish: Three-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 - METAL BUILDING SYSTEMS for sealants applied during louver installation.

3.04 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

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. Non-load bearing steel framing members for gypsum board walls, soffits and ceilings.
      a. Custom curved tracks and framing for curved surfaces.
   2. Gypsum board assemblies attached to steel framing.
   3. Tile backing panels.
   4. Gypsum soffits.
   5. Gypsum board ceilings.
   6. Shaft wall assemblies.
   7. Resilient channels and metal furring.
   8. Suspension systems for interior gypsum ceilings and soffits.
   9. Control Joints in gypsum board ceilings, soffits, and wall assemblies.
   10. Joint treatments, tapes, compounds and finishing.
   11. Levels of finish for gypsum board surfaces

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 054000 - Cold Formed Metal Framing
   2. Section 061000 - Rough Carpentry for solid wood blocking built into gypsum board assemblies
   3. Section 061643 - Gypsum sheathing for exterior building sheathing.
   4. Section 072116 - Blanket Insulation for thermal and sound attenuation insulation installed in assemblies that incorporate gypsum board.
   5. Section 072129 - Sprayed Insulation for foam insulation installed in assemblies that incorporate gypsum board and/or non-load bearing framing.
   6. Section 078400 - Firestopping for firestopping systems and fire-resistive-rated joint sealants.
   7. Section 078600 - Smoke Barrier Systems for through penetrations smoke barrier systems.
   8. Section 095100 - Acoustical Ceiling suspension assemblies for suspension systems for gypsum ceilings.
   9. Section 099100 - Painting for GWB primers and finish painting.

1.03 STANDARDS

A. All work of this section shall conform to industry standards and/or manufacturer’s recommendations.

B. ASTM C11 "Standard Terminology Relating to Gypsum and Related Building Materials and Systems".

C. ASTM C475/C475M "Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board".

D. ASTM C645 "Standard Specification for Nonstructural Steel Framing Members".

E. ASTM C754 “Standard Specification for Installation of Steel Framing Members To Receive Screw-Attached Gypsum Board, Backing Board, or Water-Resistant Backing Board”.

F. ASTM C840 “Standard Specification for Application and Finishing of Gypsum Board”.

G. 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".

H. ASTM C1047 "Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base".

I. ASTM C1396/C1396M “Standard Specification for Gypsum Board”.

J. GA-216 “Recommended Specifications for the Application and Finishing of Gypsum Board”.

K. GA-253 "Application of Gypsum Board to Form Curved Surfaces".

L. Recommended Levels of Gypsum Board Finish” published jointly by AWCI, CISCA, GA and PDCA.

M. Gypsum Board Construction Technology: Refer to ASTM C11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.04 TERMINOLOGY

A. The terms “drywall”, “GWB”, “gypsum board”, “gypsum wallboard”, and “sheetrock” are synonymous.

1.05 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide interior non-load-bearing metal 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 Framing Systems:
         1) Maximum Deflection: L/240 at 5 psf, stud spacing at 16 inches o.c.
   2. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 129° F.
   3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of ¾ inch.

B. Cold-Formed Steel Framing, General: Design according to AISI’s “Standard for Cold-Formed Steel Framing - General Provisions”.
   1. Provide interior framing systems sized to accommodate maximum deflection using limiting heights of metal studs without contribution of gypsum wallboard (non-composite).

C. 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 E 119 by an independent testing agency.

D. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.06 SUBMITTALS

A. Pursuant to Section 013300 - Submittal Procedures.

B. Pursuant to Section 016000 - Product Requirements

C. Submit manufacturers' product information, specifications, and installation instructions for the specified products including, GWB, joint compounds, fasteners, trim, control joints, joint reinforcing, metal furring members, metal studs, tracks, runners, bridging, resilient channels, steel grounds, and all related accessories.

D. Test Reports: For all stud framing products that do not comply with ASTM C645 or C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. LEED Submittals:
   1. Credit MR 4.1 and MR 4.2: Provide documentation indicating how the requirements of Credit MR 4.1 and MR 4.2 will be met.
      a. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
      b. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
   2. Product Certifications for Credit MR 5: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
   3. Credit IEQ 4.1: Provide manufacturer's product data for installation adhesives used to laminate gypsum board panels to substrate, including printed statement of VOC content.

1.07 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. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials either from the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

E. 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.

3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pursuant to manufacturers published instructions.

B. Protect against moisture exposure, condensation, direct sunlight, construction damage and other potential causes of damage.

C. Neatly stack gypsum panels flat to prevent sagging.

D. Do not install GWB that is wet, that is moisture damaged, and/or that is mold damaged.

1.09 ENVIRONMENTAL CONDITIONS

A. General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 and with gypsum board manufacturer's written recommendations, whichever is more stringent.

B. Room Temperatures: For non-adhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours prior to application and continuously after. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
   1. Once any interior GWB is installed maintain temperature within all areas of GWB installation to stay between the range of 50 degrees to 90 degrees until permanent HVAC system is fully operational and regulated.

C. Provide adequate ventilation to carry off excess moisture. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

D. Do not install gypsum board that is wet, those that are moisture damaged, and those that are mold damaged.

1.10 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

B. Rated or Tested Assemblies: As specified under the individual assembly description and shown in the drawings.

C. Non-rated Assemblies: As specified under the individual assembly description and shown in the drawings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:
   1. Gypsum Board and Related Products
      a. CertainTeed
      b. G-P Gypsum Corp.

c. National Gypsum Company
d. USG Corporation.

2. Steel Framing and Furring
   a. ClarkDietrich Building Systems
   b. National Gypsum Company
   c. United States Gypsum Company
   d. Marino/Ware: a Division of Ware Industries, Inc.

2.02 MATERIALS

A. Runners: "U" shaped steel of same type, gage, and finish as studs with web depth compatible with studs and designed to hold studs temporarily in place at top and bottom by friction.
   1. Top Runners (Track): Where framing extends to overhead structural supports and/or decking, install to produce joints at top of framing systems that prevent axial loading of finished assemblies. In fire rated walls use Firestop Deflection Track.

B. Steel Stud Framing:
   1. Channel shaped with return leg.
   2. Non-load bearing: ASTM C 645.
   3. Hot dip galvanized:

C. Metal/Rigid Furring Channel:
   1. Product: ASTM C645.
   2. Hot dip galvanized:

D. Resilient Channel:
   1. Product: Sound Transmission Resilient Channel.
   2. Corrosion-resistant steel channel.

E. 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.
   1. Products: Subject to compliance with requirements, provide one of the following:
   2. ClarkDietrch Building Systems; BlazeFrame.
   3. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Posi Clips.
   4. Metal-lite, Inc.; The System.
   5. Sliptrack Systems; SLP-TRK.

F. Deflection Track:
   1. Double track condition.
   2. Oversized outer track (2” deep minimum).
   3. Long leg inside track.
   4. Same gage or heavier than studs.
   5. Hot dip galvanized.

G. Bridging
   1. Cold-rolled Channel Bridging
      a. 16 Gauge (minimum) screwed to each stud with a clip angle not less than 1-1/2" x 1-1/2", 16 gauge, galvanized steel. Clip angle to be screwed to bridging at each stud. Use 3-3/8" wide clips for 3-5/8" studs and 5-3/4" wide clips for 6" studs. Two screws into bridging and two screws into stud.

H. Hat-Shaped Rigid Furring Channels: ASTM C645
   1. Minimum Base-Metal Thickness: 20 gauge.

2. Depth: 7/8 inch, 1-1/2 inches as indicated on the Contract Drawings.

I. Resilient Furring Channels: 1/2-inch deep, 20 gauge galvanized steel sheet members designed to reduce sound transmission.
   1. Configuration: Asymmetrical, single leg with 1-1/2" screw flange.

J. Z-Shaped Furring: With non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-metal thickness of 16 gauge unless noted otherwise and depth required to fit insulation thickness indicated.

K. Blocking
   1. Solid wood - See Section 061000 - Rough Carpentry

L. Column and beam clip
   1. “The Claw” manufactured by Claw International, 139 Parkview Drive, Lakeview, AR 72642 Phone: 870-431-5654 www.BEAMCLIPS.com or Architect Approved equivalent.

M. Fasteners:
   1. Steel drill screws; for fastening gypsum boards to steel members from 0.033 to 0.112 in. thick: ASTM C954.
   2. Steel drill screws:
      a. Type S: for fastening gypsum board to steel framing members.
      b. Type W: for fastening gypsum boards to wood members.
      c. Type G: for fastening gypsum board to gypsum board.
   3. Concrete anchors: Sized for installation loads imposed.
      a. Power driven.
      b. Pre-drilled expansion type.
      c. Self-drilling expansion type.

N. Gypsum Wall Board:
   1. Recycled Content of Gypsum Panel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
   2. Size: Provide maximum lengths and widths available that will minimize joints in each area, correspond with support system indicated, and be efficient in unusable off-cuts and waste.
   3. Gypsum Board (GWB):
      a. Type ‘X’ unless noted otherwise.
      b. Thickness: 5/8” GWB unless noted otherwise.
   4. Curved Gypsum Board
      a. Thickness: ¼” GWB, provide 2 layers
      b. Use wet method to form curves of less than 10’ radius.
   5. Cementitious Board:
      a. Provide on all surfaces to receive tile finish in shower area only.
      b. Thickness: 5/8”
   6. Gypsum Soffit Board
      a. Description: Specially formulated core to resist sag and moisture.
      b. UL classified Type TG-C and ULC classified Type C.
      c. Flame Spread Rating:15, Smoke Developed Rating: 0.
      d. Thickness - 5/8” unless noted otherwise.
      e. Products:
         1) ToughRock® Fireguard C Soffit Board by Georgia Pacific.
         2) CertainTeed Exterior Soffit Type C Gypsum Board.
      f. Use:
         1) Provide on all exterior soffit/ceiling locations.
         2) Provide on interior soffit locations where noted on Drawings.
   7. Abuse Resistant Type

a. Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.
b. Core: 5/8", Type X
c. Long Edges: Tapered.
d. Abuse-Resistant Performance:
    1) Surface Abrasion: ASTM D 4977, 0.015" at 50 rubs.
    2) Surface Indentation: ASTM D 5420, 0.15" maximum.
    3) Soft-Body impact: ASTM E 695, surface failure at 150 ft-lbs. minimum.
e. Products:
    1) Georgia Pacific DensArmor Plus® Fireguard® Abuse-Resistant Interior Gypsum Panel.
    2) Gold Bond® XP® Hi-Impact® Gypsum Board.
    3) Sheetrock® Brand Mold Tough® VHI Firecode X Panels
    4) Certainteed Extreme Abuse Resistant Gypsum Board with M2 Tech® Type X.

8. Shaftwall
    a. Liner Boards:
        1) ASTM C442, Type SLX
        2) Edges: Beveled
        3) Thickness: 1"
        4) Acceptable Product: Sheetrock gypsum liner panels by USG or Architect approved equivalent meeting the required ratings.
    b. Face Boards:
        1) ASTM C1396 (Section 5), type X
        2) Thickness: 5/8"
9. Tile Backing Panels
    a. Provide on all walls to receive ceramic tile except shower walls.
    b. Glass-mat, Water-Resistant Backing Board
        1) Complying with ASTM C 1178.
        2) Core: 5/8", Type X
        3) Products:
            (a) DensShield® Tile Backer by Georgia Pacific Gypsum.
            (b) FIBEROCK® Tile Backerboard by USG

O. Gypsum Board Accessories:
1. All accessories must be taped.
2. Galvanized steel; ASTM C1047
3. Corner bead: Solid flange.
4. Expansion (control) joint, with removable strip.
5. U-bead.
6. L-bead:
    a. Solid flange.
    b. Tear away L-bead at window applications.
7. LK-bead: Solid flange.
8. LC-bead: Solid flange.
9. Edge trim: Tapeable J-bead.

P. Joint Finishing Materials: ASTM C475
1. Joint reinforcing tape: ASTM C475
    a. Size: not less than 1-7/8 in. or more than 2-1/4 in.
    b. Thickness: Not more than 0.012 in.
    c. Tensile strength: Not less than 30 lb./in. when tested pursuant to ASTM C474.
    d. Dimensional stability: Expansion no more than 0.40% lengthwise and not more than 2.5% crosswise when tested pursuant to ASTM C474.

2. Glass fiber joint reinforcement tape: Open weave tape; ASTM C475.
3. Joint compound: Provide one or more of following pursuant to ASTM C475:
   a. Ready-mix or dry taping or bedding compound.
   b. Ready-mix or dry finishing or topping compound.
   c. Ready-mix or dry all-purpose compound.
   d. Compounds selected to be compatible.

2.03 STEEL FRAMED PARTITION: (NON-LOAD BEARING)

A. Fire Rating: Per Drawings.

B. Steel Framing:
   1. Runners, floor and ceiling:
      a. Size: As shown on the drawings.
      b. Material: 20 gage MSG (minimum) galvanized standard steel track: or 33 mil (33 ksi) if using ViiperStud®, ProSTUD®, or other proprietary stud system unless noted otherwise on the Drawings.
      c. Attachment to Floor and Ceiling: 16 in. o.c., maximum.
   2. Steel Studs:
      a. Size: As shown on the drawings.
      b. Material: 20 gage MSG (minimum) standard, galvanized steel stud; 33 mil (33 ksi) ViperStud®; 33 mil (33ksi) ProSTUD®; 33 mil (33 ksi) for other proprietary stud unless noted otherwise on the Drawings.
      c. Spacing: As shown on the Drawings.

C. Bridging:
   1. U-Channel
      a. 16 gauge (minimum).
      b. 4’-0” o.c. vertically (maximum). Screwed to each stud. Provide bridging within 12" of the stud end at deflection top track.
   2. Blocking
      a. FR Solid Wood - See Section 061000 - Rough Carpentry.

D. Boards, Both Sides:
   1. Layers: As required for fire rating of wall assembly:
      a. Edge: Tapered.
      b. Type: As listed in 2.02 N.
      c. Orientation: Parallel with studs or perpendicular to studs.

E. Fasteners: Steel drill screws.

2.04 STEEL FRAMED PARTITIONS (LOAD BEARING FIRE RATED ASSEMBLY)

A. Fire Rating: Per drawings.

B. Steel Framing:
   1. Runners, floor and ceiling:
      a. Size: As shown on the Drawings.
      b. Material: As shown on Drawings and in Section 054000 - Cold Formed Metal Framing.
      c. Attachment to Floor and Ceiling: 16” o.c., maximum.
   2. Steel Studs:
      a. Size: As shown on the Drawings.
      b. Material: As shown on Drawings and Section 054000 - Cold Formed Metal Framing.
      c. Spacing: As shown on the Drawings.

C. Bridging:
   1. U-Channel
      a. 14 gauge (minimum).
      b. 4’-0” o.c. vertically (maximum). Screwed to each stud. Provide bridging within 12" of the stud end at deflection top track.
   2. Blocking
      a. FR Solid Wood - See Section 061000 - Rough Carpentry.

D. Boards, Both Sides:
   1. Layers: As required for fire rating of wall assembly.
   2. Material:
      a. Interior wall assembly:
         1) Edge: Tapered.
         2) Type: As listed in 2.02 I.
         3) Orientation: Parallel with studs or perpendicular to studs.
      b. Exterior wall assembly:
         1) Interior face of wall assembly:
            (a) Edge: Tapered.
            (b) Type: As listed in 2.02 I.
            (c) Orientation: Parallel with studs or perpendicular to studs.
         2) Exterior face of wall assembly
            (a) See Section 061643 - Gypsum Sheathing

E. Fasteners: Steel drill screws

2.05 STEEL FRAMED PARTITIONS (LOAD BEARING UNRATED ASSEMBLY)

A. Rating: None

B. Steel Framing:
   1. Runners, floor and ceiling:
      a. Size: As shown on the drawings.
      b. Material: As shown on drawing and spec Section 054000 - Cold Formed Metal Framing.
      c. Attachment to Floor and Ceiling: 16” o.c., maximum.
   2. Steel Studs:
      a. Size: As shown on the drawings.
      b. Material: As shown on drawing and Section 054000 - Cold Formed Metal Framing.
      c. Spacing: As shown on the Drawings

C. Bridging:
   1. U-Channel
      a. 14 gauge (minimum).
      b. 4’-0” o.c. vertically (maximum). Screwed to each stud. Provide bridging within 12" of the stud end at deflection top track.
   2. Blocking
      a. FR Solid Wood - See Section 061000 - Rough Carpentry.

D. Boards, Both Sides:
   1. Layers: Single, face layer only.
   2. Material:
      a. Interior wall assembly:
         1) Type: As listed in 2.02 N
         2) Edge: Tapered.

3) Orientation: Parallel with studs or perpendicular to studs.

b. Exterior wall assembly:

1) Interior face of wall assembly:

(a) Type: As listed in 2.02 N.

(b) Edge: Tapered.

(c) Orientation: Parallel with studs or perpendicular to studs.

2) Exterior face of wall assembly

(a) See Section 061643 - Gypsum Sheathing.

3. Fasteners: Steel drill screws

2.06 FURRED ASSEMBLY

A. Rating: None.

B. Metal/Rigid Furring Channel:

1. Orientation: Installed vertically.
2. Type: DWC.
3. Depth: 7/8” or 1 ½” in.
4. Gage: 20.
5. Finish: Galvanized, G60.
6. Substrate Attachment:
   a. Direct Method: Fasten alternately through both flanges directly to wall substrate at 24 in. o.c., maximum.
   b. Fasteners to substrate: Steel power driven fasteners.

C. Metal Furring Stud:

1. Orientation: Installed vertically.
2. Type: DWS.
3. Depth: 1 5/8”.
4. Gage: 20
5. Finish: Galvanized, G60.
6. Substrate Attachment:
   a. No attachment to substrate. Furring studs and GWB are an independent system when built tight to substrate.

D. Boards and Sheathing:

1. Layers: Single, face layer only.
2. Face layer:
   a. Type: As listed in 2.02 N.
   b. Edge: Tapered.
   c. Orientation: Parallel with, or perpendicular to, framing.

E. Fasteners: Steel drill screws.

2.07 STEEL FRAMED NON-LOAD BEARING SOFFIT, FASCIA, AND EXTERIOR SHEATHING

A. Rating: None.

B. Installation Type: Braced.

C. Steel Framing:

1. Runners, floor and ceiling:
   a. Size: As shown on the Drawings.

b. Material: 20 gage MSG (minimum) galvanized steel track or 33 mil (33 ksi) if using ViiperStud®, ProSTUD®, or other proprietary stud system unless noted otherwise on the Contract Drawings.
c. Attachment to substrate: steel drill screws at 24-in. o.c., maximum.

2. Steel Studs:
a. Size: As shown on the Drawings.
b. Material: 20 gage MSG (minimum) standard, galvanized steel stud; 33 mil (33 ksi) ViperStud®; 33 mil (33ksi) ProSTUD®; 33 mil (33 ksi) for other proprietary stud unless noted otherwise on the Drawings.
c. Spacing: 16" o.c. unless noted otherwise on the Contract Drawings.

D. Diagonal Bracing: Use studs or runners.

E. Boards:
1. Layers: Single, face layer only.
2. Material:
a. Interior assembly:
1) Gypsum soffit board Type X
2) Edge: Tapered.
3) Orientation: Parallel with studs or perpendicular to studs.
b. Exterior wall assembly:
1) See Section 061643 - Gypsum Sheathing.
c. Exterior soffit:
1) Exterior rated, fire rated gypsum soffit board.

F. Fasteners: Steel drill screws.

2.08 SUSPENDED GYPSUM BOARD CEILING GRID SYSTEM

A. Rating: None.

B. Furring ceiling assembly Number 640 as manufactured by Chicago Metallic 1-800-323-7164 or Architects approved equal.
1. Orientation: Installed perpendicular to ceiling assembly.
2. Main Runner 640-C.
3. Furring Channel 634-C.
4. Furring Tee 644-C.
5. Cross Tee 659-C.
6. Perimeter Trim
7. Infinity D 4” high perimeter trim 044715.00

C. Boards and Sheathing:
1. Layers: Single, face layer only.
2. Face layer:
a. Type: As listed in 2.02 N.
b. Edge: Tapered.
c. Thickness: As shown on the drawings.
d. Orientation: Parallel with, or perpendicular to, framing.

D. Fasteners: Steel drill screws.

2.09 FURRING FOR GYPSUM BOARD CEILING ATTACHED TO WOOD TRUSSES

A. Resilient Furring Channel (20-gauge, single leg) mounted perpendicular to bottom chord of truss at 16” o.c. maximum.

B. Rating: One (1) hour or as noted on the Drawings.

2.10 FURRING FOR GYPSUM BOARD ATTACHED TO METAL TRUSSES (TRUSS SPACING GREATER THAN 2'-0" O.C.)

A. 1-1/2" Heavy Duty Furring Channel 16-gauge, (SSMA 150F125-54) mounted perpendicular to bottom chord of truss at 16" o.c. maximum and at each side of control joints.
   1. Secure furring channel to each truss with a minimum of two screws.

B. 1-1/2" Heavy Duty "U" Channel 16-gauge, (SSMA 150U-54).
   1. Provide at any opening in GWB Ceiling, flush with cut edge of GWB. At sides of opening perpendicular to trusses, run "U" channel from truss to truss. At sides of opening parallel to trusses, run between perpendicular "U"channels framing opening.

2.11 FURRING FOR BOARD INSULATION

A. "Z" Furring Channel, 16 gauge, Galvanized G40EQ Coating, profile depth to match insulation thickness.

B. To be installed in vertical configuration only, 16" on center unless noted otherwise.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Ceiling Anchorage: Coordinate ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorage to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

3.03 INSTALLATION

A. Install Pursuant to: Manufacturer's published instructions. Comply with ASTM C754 and with ASTM C840 requirements that apply to framing installation.

B. Install supplementary framing, and FR solid wood blocking to support fixtures, equipment services, heavy trim, casework, TV mounts, projection screens, white boards, bulletin boards, lockers, hand rails, grab bars, toilet accessories, furnishings, or similar construction including Owner furnished items requiring attachment.

C. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

D. Install bridging at 4'-0" o.c. vertically for full length of wall. If wall has a top deflection track, install an additional row of bridging within 12" of the top end of the studs. Install bridging prior to electrical conduit, piping and other utility installation within the wall or passing thru the wall to avoid conflicts. If bridging can not run full length of wall due to obstruction, continue bridging

above or below obstruction overlapping one full stud cavity of main bridging run. Do not exceed 2 feet vertical between offset bridging runs and primary bridging run.

E. Install bracing at terminations in assemblies.

F. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

G. Runner Installation:
   1. Attach steel runners at floor and ceiling to structural elements with suitable fasteners located 2 in. from each end and spaced 16 in. o.c., maximum.

H. Steel Stud Installation:
   1. Position studs vertically, with open side facing in the same direction, engaging floor and ceiling runners, and spaced pursuant to specific partition description. Trade holes (knockouts) shall not be located within 10 inches of the end of the stud. When necessary, splice studs with 8 in. nested lap and two positive attachments per stud flange. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners, and existing construction elements. Where studs are installed directly against exterior walls and a possibility of water penetration through walls exists, install asphalt felt strips between studs and wall surfaces.
   2. Anchor both flanges of all studs to ceiling (unless it is deflection track) and floor runner or track flanges as specified under specific partition description, or, if silent, with metal lock fastener tool, or 3/8 in. Type S or Type S-12 steel drill screw. Securely anchor studs to jamb and head anchors of door or borrowed-light frames by bolt or screw attachment. Over metal door and borrowed-light frames, place horizontally a cut-to-length section of runner or track, with a web-flange bend at each end, and secure to strut-studs with 2 screws in each bent web. Position a cut-to-length stud (extending to ceiling runner or track) at vertical board joints over door frame header.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a maximum 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.

I. Metal/Rigid Furring Channels Erection:
   1. Direct attachment: Attach furring channels in a vertical position directly to interior concrete or masonry surface with appropriate anchors and fasteners staggered 16 in. o.c. on opposite flanges. When there is a possibility of moisture penetration through walls, install asphalt felt protection strip between furring channel and wall.

J. Soffit and Fascia Erection:
   1. Fasten runners to concrete or masonry substrate with appropriate fasteners spaced 16 in. o.c., maximum. Fasten runners to steel studs used as a substrate used as a substrate with steel drill screws.
   2. Fasten steel studs to runners and other steel studs with steel drill screws.
   3. Install steel stud diagonal bracing, if necessary; fasten with steel drill screws.

K. Gypsum Board Erection:
   1. Clean stud and furring cavities of all construction debris and vacuum clean all track sections prior to installing GWB.
   2. Apply gypsum boards pursuant to specific partition description. Position all edges centered over studs for parallel application; all ends centered over studs for perpendicular application. Use maximum practical lengths to minimize end joints. Fit ends and edges closely, but not forced together.

3. Stagger vertical board joints from joints in adjacent layer and from joints on opposite side of studs. Stagger horizontal joints 1 stud spacing from boards directly above and below, from joints in adjacent layer, and from joints on opposite side of studs. Locate screws 1/2 in. from board edges or ends.
4. Fit gypsum panels around ducts, pipes, and conduits.
5. Where partitions intersect structural members and/or decking projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members and decking flutes; allow 1/4"-3/8" wide joints to install sealant or firestopping.
6. For single-layer parallel application of gypsum boards, space screws pursuant to specific partition description in field of boards and along vertical abutting edges. For single-layer perpendicular board application, space screws pursuant to specific partition description in field and along abutting end joints.

L. For single layer application erect and fasten gypsum boards pursuant to GA-216.

M. For double layer application erect and fasten gypsum boards pursuant to GA-216.

N. For exterior gypsum boards, erect pursuant to GA-216, and fasten at 6” o.c. along panel edge locations and 12” o.c. field locations with 1¼” S #6 screws.

O. Furring Installation for Suspended Gypsum Board Ceiling.
1. Install per manufactures instructions, 16” o.c. maximum spacing.

P. All joints and screw heads in GWB construction not exposed to view shall be fire taped and finished to a minimum AWCI Level 2 finish.

3.04 ACCESSORY APPLICATION

A. Corner Bead:
1. Reinforce all vertical and horizontal exterior corners with corner bead fastened by crimping at 6” o.c. on both flanges along entire length of bead. If framing is wood, apply screws at 9” o.c. both flanges along entire length of bed in addition to crimping.

B. Edge Trim:
1. Where assembly terminates against masonry or other dissimilar material, apply tapeable metal trim over board edge and fasten with 9/16 in. galvanized staples 9” o.c.

C. Opening Trim:
1. Provide and attach with screws 9” o.c. special J-type (semi-finishing) zinc-alloy edge trim at all exposed edges of exterior gypsum board that are not concealed by applied moldings.
2. Provide and attach with screws 9” o.c. special J-type plastic edge trim at all exposed edges of exterior gypsum board that are not concealed by applied moldings.

D. Control Joints:
1. Provide control joint units, of either metal or PVC at one side of door frame extending from door frame head upward to top track and/or window unit extending from window jamb upward and downward at a maximum spacing of 24’ o.c. of straight wall and for straight wall sections longer than 24’ without a door or window provide full height control joint extending from door frame head upward to top track and elsewhere, where control joints are indicated.
2. Control joints shall be provided in gypsum board ceilings not more than 30’-0” o.c. in each direction and at junction of gypsum board partitions with walls or partitions of other finish materials, and at “T”, “U” and “I” shaped areas.
3. Each side of a control joint must be independently supported.
4. Provide acoustical sealant at control joints as recommended by Drywall System manufacturer.

5. In fire rated assemblies, control joints shall be backed as required to maintain rating of wall or ceiling.
6. Where gypsum board is vertically continuous, as at stairwells, provide control joints at each floor level.

3.05 CONTROL JOINT INSTALLATION

A. Attach control joint with screws or Architect approved substitution, spaced not over 6 in. apart in each flange. Cut end joints square and align for neat fit. Remove protective tape when joint treatment is completed.

3.06 FASTENER APPLICATION

A. Drywall Screws:
1. Power-drive with an electric screwdriver so screw heads provide a slight depression below surface of gypsum boards without breaking face paper. Do not drive screws closer than 3/8 in. from edges and ends of gypsum boards.

3.07 PRE-FILL APPLICATION

A. Use ready-mix or field mix dry taping or bedding compound pursuant to directions on container. Do not over mix, nor use extremely cold water or cold joint compound.

B. Pre-fill all "V" grooves formed by abutting tapered eased edges of gypsum board with taping or bedding compound, or Architect approved substitution, using a flexible 5 in. or 6 in. joint finishing knife or specialty pre-fill tool. Fill "V" joint flush and wipe off excess compound beyond "V" groove, leaving a clear depression to receive tape. Allow pre-fill to harden prior to next application, taping, or embedding coat.

3.08 JOINT TREATMENT APPLICATION

A. Mix joint compound pursuant to manufacturer's published instructions.

B. Apply taping, embedding, or ready-mixed all-purpose compound in a thin uniform layer to all joints, angles, finishing beads, trim and control joints. Immediately apply reinforcing tape centered over joint and seated into compound. Sufficient compound, approximately 1/64 in. to 1/32 in., must remain on tape to provide proper bond. Follow immediately with a thin skim coat to embed tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. Tape or embedding coat must be thoroughly dry prior to application of second coat. Exception: Some joint compounds need only to have hardened prior to application of next coat. Refer to instructions on container.

C. Spread finish coat evenly over and extend at least 2 in. beyond second coat on all joints and feather to a smooth, uniform finish. Over tapered edges, do not allow finished joint to protrude beyond plane of surface. Apply a finish coat to cover tape and taping compound at all tapered angles and provide a true angle. Where necessary, sand lightly between coats and following final application of compound to provide a smooth surface ready for decoration. When sanding, do not roughen face paper.

3.09 FINISHING FASTENERS

A. Apply a taping, all-purpose type, or ready-mixed compound to fastener depressions as first coat. Follow with a minimum of 2 additional coats of topping or all-purpose compound, leaving all depressions level with surface.

3.10 FINISHING BEADS, TRIMS, AND CONTROL JOINTS

A. Apply first coat and tape to all flanges, and properly feather out from ground to plane of surface. Compound must thoroughly dry prior to application of second coat. Some joint compounds need only to have hardened prior to application of next coat. Refer to instructions on container.

B. Apply a second coat in same manner as first coat, extending compound slightly beyond onto face of board. Compound must be thoroughly dry prior to application of finish coat.

C. Apply finish coat, extending compound slightly beyond second coat and properly feathering from ground to plane or surface. Sand finish as necessary to provide a flat, smooth surface ready for decoration. When sanding, do not roughen face paper.

3.11 LEVEL OF FINISH

A. Surfaces to receive tile, surfaces to receive fire taping, and/or surfaces not exposed to view, shall be finished to a minimum of AWCI Level 2.

B. Surfaces to receive heavy textured finish or heavy grade wall covering shall be finished to a minimum of AWCI level 3.

C. Surfaces to receive paint or light grade wall coverings shall be finished to a minimum of AWCI level 4.

D. Surfaces to receive gloss, semi-gloss, or egg shell paint shall be finished to a minimum of AWCI level 4.

E. Level 5 finish only required in locations specifically noted on the contract drawings. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.12 TOLERANCES

A. Maximum variation of finished gypsum board surface from true flatness: 1/8 inch in 10 feet in any direction.

3.13 WASTE MANAGEMENT

A. Separate and recycle waste materials to maximize extent economically feasible in compliance with Waste Management Plan for LEED Credit MR 2.1 and MR 2.2

B. Plan and coordinate work to minimize generation of off-cuts and waste. Sequences work to maximize use of GWB off-cuts and waste.

3.14 CLEANING AND REPAIR

A. Clean all excess materials each day. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

C. Repair damaged work prior to Punch List

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. Abuse-Resistant Gypsum Board
   4. Moisture and Mold-Resistant gypsum board.
   5. Cementitious Tile Backer Board.
   6. Trim and Accessories.
   7. Joint treatment, tapes, compounds and finishing.
   8. Miscellaneous metal framing, furring, and fasteners.
   9. Sound attenuation insulation and acoustical sealants.
   10. All related items necessary to complete the work of this section.

1.03 SUBMITTALS

A. Product Data: For each type of product.

B. Submit manufacturers' product information, specifications, and installation instructions for the specified products including joint compounds, fasteners, trim, control joints, joint reinforcing, metal furring members, metal studs, tracks, runners, resilient clips, steel grounds, and all related accessories.
   1. Trim Accessories: Full-size Sample in 12-inch (300-mm-) long length for each trim accessory indicated.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

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).

D. Abuse-Resistant Gypsum Board: ASTM C1629/C1629M, Level 3.
   1. Long Edges: Tapered.
   2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.
   3. Weight: 2.8 lbs. per sf.
   4. Flame spread rating: ASTM E84, 15.
   5. Water Absorption: ASTM C473, Less than 5%.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Core: 5/8 inch (15.9 mm), regular type; 5/8 inch Type X.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.

2.04 SPECIALTY GYPSUM BOARD

2.05 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. USG Corporation; DUROCK Cement Board.
      b. Architect approved equivalent.

2. Thickness: 1/2 inch
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.
4. Tape: 2 inch wide, coated glass fiber tape for joints and corners;

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 Drawing Scehdule Item: (WCT-1)
      d. Wallcovering Base / Termination: WCTBT125-217 Drawing Schedule Item: (WCT-2)
      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.

C. Sound Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining 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. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
      b. Grabber Construction Products; Acoustical Sealant GSC.
      c. Pecora Corporation; AC-20 FTR AIS-919.
      d. USG Corporation; SHEETROCK Acoustical Sealant.
      e. Architect approved equivalent.

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.
   3. Abuse-Resistant 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.

C. Cementitious Backer Units: ANSI A108.11, at showers and locations indicated to receive tile.

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.

F. Cementitious Backer Units: 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

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. Stone thresholds.
   4. Waterproof membrane.
   5. Uncoupling Membranes.
   6. Tile backing panels.
   7. 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 (PCT-1) & (PCT-2)
   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; Division of Dal-Tile International Inc.: VOLUME 1.0
      b. Architect approved equivalent
   2. Face Sizes: 12 x 24 or as indicated on the drawings
   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. Grout width: 3/16 inch.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as selected from manufacturer's standard shapes.
    a. Base Trim: 3 x 12 Bullnose, 6 x 12 Cove Base, and 1 x 6 Cove Base Outcorner or as indicated on the drawings

B. Tile Type: Porcelain ColorBody glazed floor tile. (CT-1) & (CT-2)
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; Division of Dal-Tile International Inc.: MEDIAN
    b. Architect approved equivalent
2. Face Sizes: 24 x 24 or as indicated on the drawings
3. Thickness: 3/8 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. Grout width: 1/8 inch as indicated on the drawings.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as selected from manufacturer's standard shapes.
    a. Base Trim: 4 inch x 24 inch Floor Bullnose, 6 inch x 12 inch Cove Base, and 1 inch x 6 inch Cove Base Outcorner or as indicated on the drawings

C. Glazed Wall Tile:(CT-3), (CT-4), & (CT-5)
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; Division of Dal-Tile International Inc: Colorwheel Linear.
    b. Or approved equal.
2. Module Size: 4 1/4 inches x 12 7/8 inches and 24 inches x 8 inches 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: Biscuit K175 and Desert Gray X114
7. Tile Patterns: As indicated on the drawings.
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 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface. Comply with ICC A117.1 requirements.
2. Size: 6 inches toe to toe unless noted otherwise. Cope thresholds to door frame profile.

B. Granite Thresholds: ASTM C615/C615M, with honed finish.
1. Description: Uniform, medium-grained, Gray stone without veining.

2.04 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.

2.05 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.

2.06 UNCOUPLING MEMBRANE

A. Schluter®-DITRA or approved equal.
   1. Description: 1/8" (3 mm) thick, orange, high-density polyethylene membrane with a grid structure of 1/2" x 1/2" (12 mm x 12 mm) square cavities, each cut back in a dovetail configuration, and a polypropylene anchoring fleece laminated to its underside. Conforms to definition for uncoupling membranes in the Tile Council of North America Handbook for Ceramic Tile Installation; and 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. Manufacturer: Schluter Systems, L.P., 194 Pleasant Ridge Road, Plattsburgh, NY 12901-5841. Tel.: (800) 472-4588. Fax: (800) 477-9783. E-mail: specassist@schluter.com. Internet: www.schluter.com.
   3. Waterproofing seaming membrane:
      a. Provide with Schluter®-KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.

B. MAPEI Mapeguard UM
   1. Description: Premium-performance, lightweight, waterproofing and vapor-pressure-equalizing underlayment membrane that provides crack suppression for use under ceramic tile and stone installations as well as underneath self-leveling engineered cement products. Provides reduced "roll memory" and is also "fast track ready" over green concrete and mortar beds.
   2. Waterproofing seaming membrane:
      a. Provide with Mapeguard ST

2.07 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.

B. Epoxy Adhesive and Mortar Bond Coat: ANSI A118.3.
   1. Applications: Where indicated on drawings.
   2. Products:

a. Custom Building Products; EBM-Lite Epoxy Bonding Mortar: www.custombuildingproducts.com/#sle.
b. LATICRETE International, Inc; LATICRETE LATAPOXY 300 Adhesive: www.laticrete.com/#sle.
c. MAPEI Corporation; Kerapoxy 410
d. Merkrete, by Parex USA, Inc; Merkrete Pro Epoxy: www.merkrete.com/#sle.

2.08 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: 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.

2.09 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 079200 - JOINT SEALANTS.
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 079200 - JOINT SEALANTS for additional information.

2.10 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, 300 Series exposed-edge material.

C. Decorative Color Coated Tile Edge and Finishing Profiles: Schluter®-RONDEC- (TLMEC-1), 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.

2.11 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 079200 - METAL BUILDING SYSTEMS.

I. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
   1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
   2. Do not extend waterproofing or crack isolation membrane under thresholds set in latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing or crack isolation membrane with elastomeric sealant.

J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

K. 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.
   2. Tile Installation F122A: Thin-set mortar on waterproof membrane; TCNA F122A.

a. Tile Type: Glazed Porcelain floor tile.
b. Thin-Set Mortar: Latex- portland cement mortar.
c. Grout: Polymer-modified sanded unsanded 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

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. Seamless Acoustical Ceiling Panels.

D. Acoustical Clouds

E. Exposed Grid Suspension Systems - 9/16 inch

F. Exposed Grid Suspension Systems - 15/16 inch

G. Extruded Moldings, Trims and Shade Pockets

H. FRP Acoustical Grid System.

I. Acoustical Sealants.

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.

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.

C. Provide manufacturer's 1-year limited warranty covering defects in materials and / or factory workmanship for Acoustical canopy 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/SEI 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. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

E. 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.

F. 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 (ARMSTRONG - CALLA) (ACP-1)

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.: Calla 9/16 inch Tegular.
   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: Square Tegular.

J. Thickness: 1 inch (25.4 mm).

K. Modular Size: 24 by 24 inches.

L. Grid size: 9/16 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.

2.04 ACOUSTICAL CLOUDS - SOUNDSCAPES SHAPES (ACP-2) AND (ACP-3)

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.: SOUNDSCAPES Shapes
   2. Architect approved equivalent.

B. Classification: Provide panels complying with ASTM E1264 for type, form, and pattern as follows:
   1. Type and Form: Type XII, Form 2, Pattern E. Panels with factory painted DuraBrite scrim on face and back. Side are painted. Panel Arc- 129 inch radius. Panels shall have embedded, flush-mounted hardware system and aircraft cable support kits.
   2. Performance Characteristics:
      a. Anti Mold & Mildew.
      b. Sag Resistant. - HumiGuard+
      c. Water Repellent.
      d. Washable.
      e. Scratch Resistant.
      f. Soil Resistant.
      g. Recycled Content (50%).
      h. Panel weight: 1 lb. / sq. ft.
   3. Pattern: Pattern E or as indicated by manufacturer's designation.

C. Color: White (WH)

D. LR: Not less than 0.90

E. Sabins: 1.18 Sabins psf.

F. NRC: 1.00

G. Fire rating: Class A

H. Edge/Joint Detail: Square.

I. Thickness: 7/8 inch

J. Modular Size: 3'-10" by 3'-10" Square Panels and 3'-10" by 5'-10" Rectangular Panels and as indicated on the drawings.

K. Shape: Square and Small Rectangle

L. Item Number(s): 5440, 5448, and as indicated on the drawings.

M. Recycled Content: up to 51%

N. Hanging Cable and Group Suspension Kit: 6636 - 3 kits per panel or as recommended by manufacturer.

O. Hanging Cables: 30 foot cable kits as required.

2.05 RADIAL CUSTOM CEILING SYSTEM - OPTIMA (ACP-4)

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.: OPTIMA Radial
   2. Or approved equal.

B. Classification: Provide panels complying with ASTM E1264 for type, form, and pattern as follows:
   1. Type and Form: Type XII, Form 2, Pattern E. Fiberglass Panels with factory painted DuraBrite scrim on face and back. Side are painted.
   2. Performance Characteristics:
      a. Anti Mold & Mildew with BioBlock.
      b. Sag Resistant. - HumiGuard+
      c. Water Repellent.
      d. Washable.
      e. Scratch Resistant..
      f. Soil Resistant.
      g. Recycled Content (greater than 50%).
      h. Panel weight: variable based on design.
   3. Pattern: Pattern E or as indicated by manufacturer's designation.

C. Color: White (WH)

D. LR: Not less than 0.90

E. Fire rating: Class A

F. Edge/Joint Detail: Square Tegular.

G. Thickness: 3/4 inch, 1 inch, and 1 1/2 inches

H. Modular Size: Custom Trapezoidal Lay-in.

I. Shape: Custom Trapezoidal Lay-in as indicated on drawings.
   1. Lengths: 6 inch interval from 24 inches to 66 inches.
   2. Widths: 12 inches (minimum inside radius) through 48 inches.
   3. Taper: up to 5 degrees.

J. Suspension System: Prelude XL 15/16" custom suspension system.

2.06 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. Hanger Rods Flat Hangers: 1/4 inch diameter, Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

G. 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.

H. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

J. 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.

K. Hold-Down Clips: Provide manufacturer's standard hold-down clips (Armstrong CHDC or equal) 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 or equal).

L. Retention Clips: Provide Armstrong 414 Retention Clips in Gymnasium and Activity spaces. Install as recommended by the manufacturer to secure each panel.

2.07 METAL SUSPENSION SYSTEM - 9/16 GRID

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:

B. 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. - Suprafine
   2. CertainTeed Corp.
   3. Chicago Metallic Corporation.

C. Narrow-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 A653/A653M, not less than G30 (Z90) coating designation; with prefinished 9/16-inch- (15-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. Cap Material: Steel cold-rolled sheet.
   5. Cap Finish: Painted white.

2.08 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.: 15/16 Co-extruded CLEAN ROOM.
   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.

C. Suspended Ceiling Grid Moldings: StyleStix TM - Rigid PVC; Sag, mold, mildew and bacteria resistant; snap-on grid and perimeter moldings (Items #1310, 1311 and 1312) in lengths required. System connects to a standard 15/16" grid suspension system with wall molding profile. The StyleStix system shall have the following physical characteristics:
   1. Dimensions: 1 1/2 inch wide x 3/4 inch deep x 72 inch long (#1310)
   2. Sag Resistance: HumiGuard Plus.
   3. Fire Rating: Class A
   4. Anti-microbial: Mold, Mildew and Bacteria resistant
   5. Durability: Soil, scratch and impact resistant
   6. Material: PVC
   7. Finish: White, paintable surface.
   8. Warranty: Limited Lifetime manufacturer's warranty.

2.09 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. Edge Angles, Moldings and Trims compatible with the grid specified. Provide gasketed CLEAN ROOM Edge Moldings and Trim where CLEAN ROOM grids are 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.

2.10 EXTRUDED MOLDINGS, TRIMS AND SHADE POCKETS

A. Extruded Aluminum Edge Moldings and Trim: AXIOM Knife Edge Trim types and profiles indicated. (CP-2 EDGE)
   1. Provide Factory-Bonded inside and outside corners.
   2. Color: Silver Satin and as indicated on the drawings.
   3. Size: 6 inches wide by 5 inches deep.

B. Extruded Shade Pockets: AXIOM Ceiling Perimeter Systems, Three-sided Shade Pockets. Acoustical Flange.
   1. Provide Factory-Bonded inside and outside corners.
   2. Color: as selected by the Architect from the manufacturer's full color offering.
   3. Provide with Drywall Flange where indicated on the drawings.
   4. Size: 5 inch by 5 inch by 5 inch.
   5. Length: 120 inches.
   6. Provide end Caps and Closure Clips for a complete system.

2.11 ACOUSTICAL SEALANT

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. Acoustical Sealant for Exposed and Concealed Joints
      a. Pecora Corporation ; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation: SHEETROCK Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.

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 SECTION INCLUDES

A. Luminous Canopies

B. Luminous Wings

C. Luminous Blades

D. Luminous Shapes

E. Cable hangers and fasteners

1.02 REFERENCE STANDARDS

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 A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

E. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

F. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

G. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

H. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate layout of canopies, support locations and details for ceiling suspension, and orientation of the images or patterns on luminous panels.

C. Product Data: Provide data showing ceiling component construction and finishes. Submit manufacturer's technical data for each type of canopy system required

D. Luminous Element Samples: Submit two samples, 6 by 6 inches (305 by 305 mm) in size, illustrating material, finish, and support details.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Maintenance Data: Manufacturer's instructions for cleaning and replacement.

G. Manufacturer's Qualification Statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016100 - Product Requirements, for additional provisions.
   2. Extra Luminous Ceiling Components: Two percent of total product installed, but not less than Two of each type.

1.05 QUALITY ASSURANCE

A. Coordination of Work: Coordinate canopy work with installers of related work including, but not limited to suspended ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

B. Electrical Work: Comply with requirements of NFPA 70.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

E. Single-Source Responsibility: Provide canopies and method of attachment by a single manufacturer.

1.06 MOCK-UP

A. Provide mock-up of each type of luminous ceiling system, including at least one of each component.

B. Analyze mock-up to determine illumination level and comfort achieved.

C. Mock-up may not remain as part of the Work.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver canopies to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing canopies, permit them to reach room temperature and a stabilized moisture content.

C. Handle canopies carefully to avoid damaging units in any way.

D. Building areas to receive canopies shall be free of construction dust and debris. Products can be installed up to 100°F (38°C) and in spaces before the building is enclosed, where HVAC

systems are cycled or not operating. Cannot be used in exterior applications, where standing water is present, or where moisture will come in direct contact with the canopy.

1.08 WARRANTY

A. Infusions Products: Submit a written warranty executed by the manufacturer, agreeing to repair or replace canopies that fail within the warranty period. Failures include, but are not limited to:
   1. Infusion : Manufacturer's defects.
   2. Attachment devices: Rusting and manufacturer's defects.

B. B. Warranty Period:
   1. Infusions Products: One (1) year from date of substantial completion.
   2. Attachment devices: One (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Luminous Canopy System:
   1. Armstrong World Industries, Inc.
   2. Architect approved equivalent.
   3. Substitutions: Section 016100 - Product Requirements and 012500 - Product Substitution Procedures

B. Luminous Infill Panels:
   1. USG Corporation; Translucents Luminous Infill Panels: www.usg.com/ceilings/#sle.
   2. Substitutions: Section 016100 - Product Requirements and 012500 - Product Substitution Procedures

2.02 LUMINOUS CANOPIES

A. Luminous Canopy System:
   1. Infusions Accent Canopies
      a. Surface Texture: Smooth
      b. Composition: Polycarbonate
      c. Color: Blue Arbor
      d. Size: 24 in x 72 in
      e. Thickness: dimension3Value + ' ' + dimension3UnitId
      f. Edge Detail: Square
      g. Arc Radius:
         1) Items 54051 & 54052 - 2' X 5' (60 degrees) & (90 degrees)
         2) Items 54061 & 54062 - 2' X 6' (60 degrees) & (90 degrees)
         3) Items 54101 & 54102 - 4' X 10' (30 degrees) & (50 degrees)
      h. Fire Properties: (Aluminum - Noncombustible); (Infusion Canopies have been tested according to NFPA 286 and are equivalent to Class A interior finish as defined in Chapter 8 of the International Building Code).
      i. Acceptable Product: INFUSIONS Accent Canopies, 54061 as manufactured by Armstrong World Industries, Inc. or Architect approved equivalent.
   2. Luminous Canopy Accessories:
      a. Manufacturer: Armstrong World Industries, Inc.
      b. Hanging Kits
         1) 7004 Standard 8' Hanging Kit N/A
            (a) 7005 Extended Hanging Kit - 16'
            (b) 7010 Extended Hanging Kit - 30'
      c. Wall & Ceiling Kits

1) 7041 Dual Canopy Hanging Kit
2) 7006 Escutcheon Kit Used when hanging canopy below an existing ceiling
3) 7008 Wall Attachment Kit Anchors canopies side-by-side to a wall
4) 7009 Wall End Attachment Kit Used at ends when linking single or multiple canopies

d. Linking Kits
1) 7042 Flush Spacing Kit Links two canopies side-by-side with flush spacing
2) 7043 1/2" Spacing Kit Links two canopies side-by-side with 1/2" spacing
3) 7007 3" Spacing Kit Links two canopies side-by-side with 3" spacing
4) 7044 Single Hinge Linking Kit Links two canopies end-to-end, two kits typically needed
5) 7045 Dual Hinge Flush Linking Kit Links four canopies together end-to-end and flush side-to-side
6) 7046 Dual Hinge 1/2" Linking Kit Links four canopies together end-to-end and with 1/2" spacing side-to-side
7) 7047 Dual Hinge 3" Linking Kit Links four canopies together end-to-end and with 3" spacing side-to-side]

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that mechanical work above luminous canopies has been completed and does not interfere with ceiling installation or performance.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of canopies. Comply with reflected ceiling plans. Coordinate panel layout with mechanical, electrical and sprinkler fixtures.

B. Paint surfaces and mechanical installations in cavity above luminous elements. Use 90 percent reflectance white paint applied as specified in Section 099123 or as indicated on the drawings.

C. Lay out system on room axis as indicated and as indicated on the drawings.

3.03 INSTALLATION

A. General: Install luminous canopies, hangers, and accessories in accordance with manufacturer's instructions and in compliance with the authorities having jurisdiction.

B. Suspension System:
1. Install suspension system in accordance with ASTM C636/C636M and manufacturer's instructions and as supplemented in this section.
2. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
3. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
4. Do not eccentrically load system or produce rotation of runners.

3.04 CLEANING

A. Replace damaged and broken units.

B. Clean luminous canopies in accordance with manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings and soffits.

B. Suspended metal support system and perimeter trim.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

F. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

I. ASTM E413 - Classification for Rating Sound Insulation; 2022.

J. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

1.03 DESIGN REQUIREMENTS

A. Design components to ensure light fixtures and installed accessories will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.05 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Furnish for component profiles.

C. Shop Drawings: Indicate reflected ceiling plan.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016100 - BASIC PRODUCT REQUIREMENTS, for additional provisions.
   2. Extra Linear Panels: Provide standard length panels matching the installed panels in all respects in a quantity of not less than 5% of the Linear Metal Ceiling area with a minimum of two full size panels.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section.
   1. Minimum three years documented experience.
   2. Approved by metal ceiling manufacturer.

C. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.08 WARRANTY

A. See Section 017800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Linear Metal Ceilings:
   1. Armstrong World Industries, Inc; METALWORKS Torsion Spring:; METALWORKS Blades - Classics; METALWORKS Linear- Synchro, www.armstrongceilings.com/#sle.
   2. Tavola™ Prime Beam and Baffle ceiling system manufactured by CertainTeed Architectural; 5015 Oakbrook Parkway, Suite 100, Norcross, GA 30093. Tel: (800) 366-4327; www.CertainTeed.com/Architectural
   3. Substitutions: Section 012500 - Product Susbtitutions.

2.02 LINEAR METAL CEILINGS - GENERAL

A. Linear Metal Ceiling and Soffit Systems: Panels and Blades and Soffits, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:
   1. Design to support imposed loads of indicated items without eccentric loading of supports.
   2. Design for maximum deflection of 1/360 of span.
   3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 50 or less, when tested in accordance with ASTM E84.

2.03 SYSTEMS

A. METALWORKS - Torsion Spring Interior Metal Panels: (CP-2)
   1. Type: Torsion Spring Panels with Extruded perimeter trim; downward accessible flat panels. ASTM E1264, Type XX Pattern C Fire Class A (Perforated)
      a. Size and Configuration: 24 inches wide by 72 inches long by 1 1/2 inches high.
      b. Panel Profile: Square edge
   2. Material: Aluminum sheet, ASTM B209 (ASTM B209M).
      a. Gauge: 0.040 inch (Interior).
      b. Perforations: Pattern M15 (Rd 1612)
      c. Finish: Polyester Paint
      d. Color: Whitelume and as indicated on the drawings
      e. Springs per panel; 6
      f. Filler: Integral Black Fiberglass Fleece.
      g. NRC: 0.90 (1 inch fiberglass)
      h. Fire Class: Class A, ASTM E84, Smoke Developed less than 50.
      i. Light Reflectance: 0.75
      j. Recycled Content: up to 16%
      k. Finish and color: as selcted by the Architect from the manufacturer's full pattern and color offering.
      l. Weight: 0.69 psf

B. METALWORKS Blades - Linear Metal Baffles: Suspended vertically from suspension members. (ACB-1)
   1. Profile: Beam shaped.
   2. Size: 96 inches long by 4 inches deep by 1 inch wide with caps on one end.
   3. Pattern and Spacing: As indicated on the drawings.
   4. Material: Aluminum extrusions, ASTM B221 (ASTM B221M).
   5. Sound Absorption: 0.92 Sabins per sq. ft.
   6. Perforations: Pattern M15 (Rd 1612)
   7. Recycled Content: up to 80%
   8. Finish: Anodized; Custom color as selected by the Architect.

C. METALWORKS Linear - Synchro Planks (ECP-1).
   1. Manufacturer: Armstrong World Industries or Architect approved equivalent.
   2. Profile: Plank shaped.
   3. Size: 9 inches wide by 96 inches long by 1 inch deep.
   4. Pattern and Spacing: As indicated on the drawings.
   5. Material: Aluminum extrusions, ASTM B221 (ASTM B221M).
   6. Gauge: 0.028 inch.
   7. Finish: Polyester Paint
   8. Color: White and as indicated on the drawings
   9. Perforations: M1 (unperforated)
   10. NRC: 0.70 (M2 perforated only)
   11. Fire Class: Class A, ASTM E84, Smoke Developed less than 50.
   12. Light Reflectance: 0.83
   13. Recycled Content: 58%
   14. Suspension System: Main Beam Carrier (MBC2).

15. Provide accessories as required to provide a complete system installation indicated on the drawings.

D. TAVOLA™ PRIME Beam and Baffles (ACB-3)
1. Manufacturer: Certainteed ARCHITECTURAL or Architect approved equivalent.
2. Ceiling system for interior installations providing single beam access with use of scissor clips.
3. Material: Alumnium
4. Profile: Beam shaped.
5. Size: 2 inches wide by 10 inches deep.
6. Beam Spacing: 10 inches and as indicated on the drawings.
7. Beam Lengths: Lengths as indicated on the drawings
8. Suspension:
   a. Grid: 15/16" heavy-duty T-grid
   b. Hanger Bracket Assembly: Scissor-clip beam attachment
9. Perforations:
   a. Non-Perforated
   b. Perforation Pattern: 115 on vertical sides of beam only
10. NRC: 1.15 (non-woven black 1.5 pcf poly encapsulated fiberglass)
11. Fire Class: Class A, ASTM E84, Smoke Developed
12. Light Reflectance: 0.81
13. Recycled Content: up to 85%
14. Finish: Polyester Paint.
15. Color: Cotton White and as indicated on the drawings.
16. Weight: 0.5 to 2.1 psf.
17. Provide matching End caps and accessories as required to provide a complete system installation indicated on the drawings.

2.04 ACCESSORIES

A. Acoustical Backer: Manufacturer's standard non-woven fabric; as required to achieve specified acoustic performance.

B. End Caps: 0.025 inch thick aluminum in color as selected by the Architect from the manufacturer's full color offering. Caps fabricated to match end profile of linear panels.

C. Accessories: Stabilizer bars and clips as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

D. Suspension Members: Formed aluminum sections, with integral attachment points; primed finish; size and type to suit application and ceiling system flatness requirement specified.
1. Symmetrical Carrier:
   a. Manufactured to an inverted "U" shape from 0.040 inch aluminum 144 inches long. Coated with black polyester enamel.
   b. Slotted at appropriate intervals to receive stabilizing components.
2. Stabilizer Bars: manufactured from 0.025 inch thick aluminum, 49 13/16 inches long. Coated with black polyester enamel.
3. Radius Carrier: manufactured to an inverted "U" shape from 0.040 inch thick aluminum, 144 inches long with integral carrier tabs, painted black.

E. Suspension Wire: Steel, annealed, galvanized finish, 9 gauge, 0.1144 inch (2.91 mm) diameter.

2.05 FABRICATION

A. Shop cut linear panels to accommodate mechanical and electrical items.

B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels; back brace internal corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions for compliance with the manufacturer's installation requirements and specified tolerances, with installer present. Correct any deficiencies found before commencing the work of this section.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Verify that field measurements are as indicated on shop drawings.

3.02 INSTALLATION

A. Suspension Components:
   1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
   2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
   3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
   4. Locate suspension system for linear panel layout parallel to building lines according to reflected plan.
   5. Symmetrical Carriers: Installed 50 inches on center by direct suspension from existing structure with not less than 12 gauge hanger wires wrapped tightly 3 full turns, spaced 48 inches on center.
   6. Stabilizer Bars: Installed perpendicular to symmetrical carrier (24) (48) inches on center.

B. Linear Metal Ceiling:
   1. Install linear panels and other system components in accordance with manufacturer's instructions.
   2. Stagger end joints minimum 12 inches (300 mm) unless noted otherwise on the approved shop drawings.
   3. Butt interior end joints tight.
   4. Install filler strips between linear panels at interior locations.
   5. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
   6. Install end caps at sight-exposed ends of linear panels.
   7. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.
   8. Access Panels: Installed in accordance with manufacturers recommendations.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/16 inch in 10 feet (____ mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

C. Maximum Variation From Dimensioned Position: 1/4 inch (6 mm).

3.04 CLEANING

A. Clean exposed surfaces in accordance with the manufacturer's written instructions.

B. Replace damaged or abraded components.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood veneer planks.

B. Metal suspension system.

1.02 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.

F. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

1.03 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016100 - Product Requirements, for additional provisions.
   2. Wood Ceiling Components: Provide a quantity equal to 2 percent of total product installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section.
   1. Minimum five (5) years documented experience.
   2. Approved by wood ceiling manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.

B. Store in fully enclosed space, flat, level and off the floor.

1.06 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

B. Maintain room temperature between 60 degrees F (16 degrees C) and 75 degrees F (24 degrees C) and relative humidity between 35 to 55 percent before, during, and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Suspended Veneered Plank Ceilings: (CP-1)
   1. Armstrong World Industries, Inc: WOODWORKS Linear: www.armstrongceilings.com/#sle.
   2. Substitutions: See Section 012500 - Substitution Procedures and Section 016100 - Product Requirements.

2.02 SUSPENDED WOOD CEILING SYSTEMS

A. Performance Requirements:
   1. Design for maximum deflection of 1/360 of span.
   2. Design to resist seismic load by using practices specified in ASTM E580.
   3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 50 or less, when tested in accordance with ASTM E84.

B. Wood Veneered Plank: Type Constants: Composite wood core with wood veneer finish. including matching Factory-edge banding. ASTM E1264, Type XX; Pattern: Z, Class A.
   1. Manufacturer: Armstrong World Industries: WOODWORKS Linear or Architect approved equivalent.
      a. See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES.
   2. Plank Size: 96 inches long by 3 3/4 inches wide with 3/4 inch reveals. Nominal: 4 1/2 inch Module
   3. Plank Thickness: 3/4 inch (19 mm).
   4. Veneer Species: Walnut
      a. Veneer Cut: Vertical Grain.
      b. End Matching: Manufacturer's recommended matching.
      c. Factory Finish: Clear sealer.
      d. Color: Walnut and as indicated on the drawings.
      e. FSC certified.
   5. Fire Performance: Class A, ASTM E84, Flame Spread: 25 or less, Smoke Developed: 50 or less.
   6. NRC Range: 0.60 determined in accordance with ASTM E1264.
   7. Acoustical Backer: Factory-applied Fleece, 1 inch (25 mm) thick.
      a. Color: Black.
   8. Attachment to Suspension Grid: Manufacturer's recommended method according to panel product selected.
   9. Edge Profile: Square.
   10. Trim: AXIOM trim with adjustable trim clips. Depth: 5 inches or as indicated on the drawings.

C. Metal Suspension System:
   1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

a. Materials:
1) Aluminum Grid: Aluminum sheet, ASTM B209 (ASTM B209M).

2. Concealed Suspension System: Prelude Heavy-Duty (HD): Hot-dipped galvanized steel grid and cap.
a. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
b. Profile: Tee; 15/16 inch (24 mm) face width.
c. Finish/Color: Tech Black.

3. T-Bar Hooks, Wood Screws, Safety Cables, and Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.

D. Accessories: Manufacturer's standard accessories for installation method indicated, seismic requirements and above-ceiling accessibility.

2.03 FABRICATION

A. Shop fabricate wood ceiling components to the greatest extent possible.

B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

A. Coordinate the location of hangers with other work.

B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).

B. Wood Ceiling:
1. Install wood ceilings in accordance with manufacturer's instructions.
2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
3. Install components in uniform plane, and free from twist, warp, and dents.
4. Cut to fit irregular grid and perimeter edge trim.
5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
6. Install acoustical backer above wood ceiling components; fit tight between grid members.

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.
   2. Resilient stair accessories.
   3. Resilient molding accessories.

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 (RB-1) & (RB-2)

A. Manufacturers:
   1. Mannington Commercial.
   2. Architect approved equivalent.

B. Product Standard: ASTM F1861, Type TP (Thermoplastic Rubber).
   1. Group: 1 (solid, homogeneous).
   2. Style and Location:
      a. Style D, Sculptured: Provide types in areas indicated of the drawings.
         1) Profile: Catera.

C. Environmental Data:
   1. Indoor Air Quality: FloorScore Certified.

D. 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.
   2. Smoke Density, ASTM E662: less than 450.

E. Thickness: 0.31 inch.

F. Height: 4 inches or as indicated on Drawings.

G. Lengths: 120-foot Coils or in manufacturer's standard coil length.

H. Outside Corners: Preformed.

I. Inside Corners: Preformed.

J. Colors: As selected by Architect from manufacturer's full range of colors.

K. Adhesive: MR101 Acrylic (Mannington)

2.02 RUBBER MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Roppe Corporation, USA.
   2. VPI, LLC, Floor Products Division.
   3. Or approved equal.

B. Description: Rubber nosing for carpet reducer strip for resilient flooring joiner for tile and carpet transition strips.

C. Profile and Dimensions: As indicated.

D. Locations: Provide rubber molding accessories in areas indicated.

E. Colors and Patterns: As selected by Architect from manufacture's full range of colors and patterns.

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 resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Stair-Tread Nose Filler: Two-part epoxy compound recommended by resilient stair-tread manufacturer to fill nosing substrates that do not conform to tread contours.

D. 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. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by 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 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to 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 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have 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 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.

E. 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 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:
   1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
   2. Tightly adhere to substrates throughout length of each piece.
   3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.05 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. Luxury Vinyl Tile.
   2. Luxury Vinyl Plank.
   3. Vinyl composition floor tile.
   4. Vinyl Enhanced Tile
   5. Static Dissipative Tile (SDT)

1.03 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 E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

C. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a, with Editorial Revision.

D. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

E. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).

F. ISO 9001 - Quality Management Systems — Requirements; 2015.

G. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).

H. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2017.

I. Install resilient floor tiles in accordance with the recommended method of the "Tile Contractors Association of America" Handbook.

J. American Society for Testing and Materials (ASTM):
   1. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile.
   2. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile
   3. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   4. Federal specification SS-T-312B(1) Type IV composition product.
   5. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   6. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
   7. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

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 VCT, LVT, Solid Vinyl, and Carpet Tile 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 - NON-PENETRATING ROOFTOP SUPPORT SYSTEMS.

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 LUXURY VINYL TILE - URETHANE FINISH

A. Products:
   1. Tarkett Modular LVT: Contour Colorbeam (Basis of Design). (LVT-2) through (LVT-5)
   2. Architect approved equivalent.

B. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.

C. Tile Standard: ASTM F1700.
   1. Class: Class III - Printed Film.
   2. Type: B - Embossed Surface.

D. Critical Radiant Flux (CRF): Minimum 0.45 watts per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.

E. Smoke Developed: Smoke value 450 or less based on NBS Smoke Chamber Test when tested in accordance with ASTM E662.

F. Static Load Limit: 250 psi

G. Coefficient of Friction (ASTM D2047): 0.6 - exceeds ADA Guidelines.

H. Recommended Level of use: On Grade and Above Grade

I. Wear Layer thickness: 0.032 inch

J. Total Thickness: 0.120 inch.

K. Size: 18 inch x 18 inch

L. Colors and Patterns: As selected by the Architect from the manufacturer's full color range.

M. Adhesive: Tarkett High Moisture Substrate Adhesive, Tarkett Two-Part Urethane Adhesive, or Tarkett Two-Part Epoxy Adhesive. based on the manufacturer's recommendations for various substrates.

N. Warranty: Provide Manufacturer's Limited Warranty that material will be free from manufacturing defects for a period of 25 years from the date of Substantial Completion. Additionally, the warranty shall cover discoloration from mold, mildew and alkali.

2.03 LUXURY VINYL TILE - URETHANE FINISH- STAIR TREADS (LVT-1)

A. Products:
1. Six Degrees one-piece LVT combination Tread/Riser: Impression (Basis of Design). T: 844.432.5885
2. Architect approved equivalent.

B. Minimum Requirements: Comply with ASTM F2169, of Class corresponding to type specified.

C. Tile Standard: ASTM F1700.
1. Class: Class II - Surface Decorated.
2. Type: TV.

D. Critical Radiant Flux (CRF): Minimum 0.45 watts per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.

E. Smoke Developed: Smoke value 450 or less based on NBS Smoke Chamber Test when tested in accordance with ASTM E662.

F. Static Load Limit ASTM F970: 250 psi

G. Maximum Weight ASTM F970: 1000 psi

H. Other: 100 % Recyclable material. FloorScore Certified. Made in U.S.A.

I. Wear Layer thickness: 0.028 inch

J. Total Thickness: 0.120 inch.

K. Sizes: 14 1/8 inch Tread depth, 8 1/4 inch Riser Height, and 36 to 108 inch widths - as indicated on the drawings.

L. Colors and Patterns: As selected by the Architect from the manufacturer's full color range.

M. Adhesive: AW-510 Wet Set Adhesive, AP-520 Acrylic Pressure Adhesive, TP-620 Pressure Sensitive Tape, or MS-700 Modified Silane Adhesive based on the manufacturer's recommendations for various substrates.

N. Warranty: Provide Manufacturer's Limited Warranty that material will be free from manufacturing defects for a period of 10 years from the date of Substantial Completion. Additionally, the warranty shall cover discoloration from mold, mildew and alkali.

2.04 LUXURY VINYL PLANK

A. Products:

1. Patcraft LVP: Splitwood - Style Number 1466V.
2. Architect approved equivalent.

B. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.

C. Tile Standard: ASTM F1700.
1. Class: Class III - Printed Film.
2. Type: B - Embossed Surface.

D. Critical Radiant Flux (CRF): Minimum 0.45 watts per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.

E. Smoke Developed: Smoke value 450 or less based on NBS Smoke Chamber Test when tested in accordance with ASTM E662.

F. Static Load Limit: 250 psi

G. Coefficient of Friction (ASTM D2047): 0.6 - exceeds ADA Guidelines.

H. Recommended Level of use: On Grade and Above Grade

I. Wear Layer thickness: 0.020 inch

J. Finish: ExoGuard.

K. Total Thickness: 0.197 inch.

L. Size: 9 inches wide x 60 inches long

M. Colors and Patterns: As selected by the Architect from the manufacturer's full color range.

N. Adhesive: XpressStep Spray Adhesive or Tackifier based on the manufacturer's recommendations for various substrates.

O. Warranty: Provide Manufacturer's Limited Warranty that material will be free from manufacturing defects for a period of 15 years from the date of Substantial Completion. Additionally, the warranty shall cover discoloration from mold, mildew and alkali.

2.05 VINYL COMPOSITION FLOOR TILE

A. Products: Subject to compliance with requirements, provide one of the following as approved by the architect:
1. Armstrong World Industries, Inc.; Premium Excelon Stonetex
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: Class 2 - Through Pattern Vinyl Tile.

E. Static Load Limit: 125 psi

F. Wearing Surface: Smooth.

G. Thickness: 1/8 inch.

H. Size: 12 inch x 12 inch.

I. Colors and Patterns: As selected by the Architect from the manufacturer's full color range.

J. Certifications: Floorscore, NSF / ANSI 332 Gold, 3rd Party Certified Industry-Wide Type III EPD.

K. Warranty: Manufacturer's Limited 5 year Commercial warranty.

2.06 VINYL ENHANCED TILE

A. Products and Product Data meeting the requirements of this specification may be submitted by one of the following manufacturers for review by the Architect for this project:
   1. Johnsonite: A Tarkett Company:: Color Essence and Color Essence Slip Resistant - Basis of Design
   2. Armstrong World Industries, Inc.
   3. TOLI International
   4. Architect approved equivalent.

B. Resilient Vinyl Enhanced Tile Flooring
   1. Color Essence and Color Essence Slip Resistant – Resilient Vinyl Enhanced Tile Flooring with the following physical characteristics:
      a. Complies with requirements for ASTM F 1066, Class 3 (Surface Pattern) Standard Specification for Vinyl Composition Floor Tile.
      b. Wear layer/Overall thickness: 1/8" (3.2 mm)
      c. Tile size: 12" x 12" (30.5 x 30.5 cm)
      d. Slip Resistance: ADA Compliant
      e. Polyurethane Reinforced wear surface with Tritonite Finish
      f. ASTM F970, Standard Test Method for Static Load Limit – 400 PSI (modified for higher load).
      g. ASTM E648, Standard Test method for Critical Radiant Flux of 0.45 watts/cm2 or greater, Class I.
      h. Color Essence slip resistant tile shall be provided as indicated on the drawings.
      i. Color Essence shall be installed with Tarkett 800 Pressure Sensitive Adhesive in accordance with the manufacturers requirements.
      j. Vinyl Enhanced Tiles contain 23% pre-consumer and 6% post-consumer recycled content.
      k. Phthalate-free.
      l. 100% Recyclable.
      m. SCS FloorScore® Certified and meets California Specifications Section 01350.
      n. Johnsonite facilities shall be ISO 9001 and ISO 14001 Certified.
      o. Color/Pattern: As selected by architect from manufacturer’s full line of Color Essence and Color Essence Slip Resistant tile.

2.07 STATIC DISSIPATIVE TILE

A. Products: Subject to compliance with requirements, provide one of the following as approved by the architect:
   1. Tarkett: iQ Granit SD
   2. Architect approved equivalent.

B. Minimum Requirements: Comply with ASTM F1066 or ASTM F1700 , of Class corresponding to type specified.

1. Class: Class 1 - Solid Color Vinyl Tile.

C. Static Load Limit: 250 psi

D. Wearing Surface: Smooth

E. Thickness: 0.080 inches

F. Size: 24 inch x 24 inch

G. Colors and Patterns: As selected by the Architect from the manufacturer's full color range.

H. Electrical Properties: Installed as a system utilizing the required SDT adhesive (Armstrong S-202 or equal), grounding strips and SDT polish (Armstrong S-392), SDT will yield the following properties:
   1. Resistance:
      a. ESD-S7.1 and ASTM F-150.
      b. Point to point and point to ground: 10^6 to 10^9 ohms.
   2. Static Generation:
      a. ESD STM 97.2 (flooring in combination with footwear and a person)
         1) at 40 % RH with ESD shoes:<10 volts.
         2) at 12% RH with ESD shoes:<100 volts.
   3. Static Decay:
      a. Flooring in combination with footwear (ESD shoes) and a person (5000 volts to zero): 0.5 seconds average.
      b. Federal Test 101C, Method 4046 (5000 volts to zero)<0.5 seconds.

I. Warranty: Manufacturer's Limited 5 year Commercial warranty.

2.08 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 - 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. High Performance Cushioned Sheet Vinyl Flooring.

1.03 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

B. ASTM D3389 - Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader); 2021.

C. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs; 2017.

D. 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).

E. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

F. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2022.

G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

H. ASTM F2772 - Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems; 2011 (Reapproved 2019).

I. ASTM F386 - Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces; 2017 (Reapproved 2022).

J. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.

K. ASTM F925 - Standard Test Method for Resistance to Chemicals of Resilient Flooring; 2013 (Reapproved 2020).

L. ASTM F970 - Standard Test Method for Measuring Recovery Properties of Floor Coverings after Static Loading; 2017.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details and locations of the following
   1. Floor seaming plan.

C. Samples for Verification: For each type, color, and pattern of flooring indicated, 6-inch (150-mm) square Samples of same thickness and material indicated for the Work.

1.05 QUALITY ASSURANCE

A. Manufacturer ISO 9001 certification.

B. Installer Qualifications: Project Managers or Field Supervisors must be INSTALL (International Standards & Training Alliance) certified CFI (Certified Floorcovering Installers) Certified and/or an FCICA (The Flooring Contractors Association) CIM (Certified Installation Manager) for the requirements of the project.

C. Surfacing Contractor and their workers shall be certified and approved by the approved flooring Manufacturer.

D. Surfacing Contractor shall be fully acquainted with the existing facility and utilities and shall fully understand the difficulties and restrictions attending the execution of the work under contract.

E. Surfacing Contractor to advise the Owner of any restrictions or anticipated difficulty, in writing and prior to submitting their bid.

F. Contractor and their installers shall have performed installations of the similar scale in the last three (3) years.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified High Perfomance Cushioned Vinyl flooring Installer.

B. Provide Manufacturer’s current printed substrate surface preparation guidelines.

C. Provide Manufacturer’s current printed installation guidelines for Products supplied under this contract.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: Include maintenance data and guidelines for flooring materials in maintenance manuals.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide extra stock materials from original dye lots, for use in facility operations and maintenance (approximately 2% of the total floor surface for each color, surface texture and format of Manufactured Product specified).

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials to prevent deterioration. Replace any damaged materials with new matching materials in a timely fashion, so that the project is not delayed. Store rolls upright.

C. Materials must be delivered to site a minimum of 24 hours before work is scheduled to begin so that they may acclimate.

D. Avoid storing Manufactured Product for extended periods of time or additional material trimming may be required.

E. 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 55 deg F (13 deg C) or more than 85 deg F (29 deg C). Maintain relative humidity at service levels, or between 40% and 65% RH.

1.10 FIELD CONDITIONS

A. Adhesively Applied Products:
   1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
   2. After post installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
   3. Test floors for appropriate moisture levels required by the manufacturer prior to commencing any flooring installations.
   4. Close spaces to traffic during flooring installation.
   5. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

B. Install flooring after other finishing operations, including painting, have been completed.

1.11 WARRANTY

A. The resilient athletic flooring is warranted to be free from manufacturing defects for a period of one (1) year from the date of Substantial Completion.

B. For standard applications, the resilient athletic flooring is warranted against excessive wear under normal usage for a period of ten (10) years from the date of Substantial completion.

PART 2 - PRODUCTS

2.01 HIGH PERFORMANCE CUSHIONED VINYL FLOORING

A. Description: Cushioned (for impact) Sheet vinyl flooring specifically designed for ballet, hip hop, contemporary and modern dance activity flooring applications.

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Connor Dance Studio & Stage Floor Systems (by Gerflor): PRIMA 4.5MM
   2. Architect approved equivalent.

C. Cushioned Sheet Vinyl Flooring with Backing: ASTM F2772 - Class 2 (4.5mm).
   1. Type (Binder Content): Type II, minimum binder content of 34 percent.
   2. Wear-Layer Thickness: 2mm thick pure PVC.
   3. Roll Width: 59 inches (1.5m).
   4. Roll Length: 65 feet - 7 inches (20m)
   5. Overall Thickness: 0.18 inch (4.5mm) .
   6. Weight: 0.53 lbs./sq.ft. (2.6 kg/sq.m.) for 4.5mm product
   7. Interlayer Material: Foamed plastic.
   8. Fire Rating: ASTM E648 Class 1.

D. Application Method: Spray Adhesive or Tape

E. Traffic-Surface Texture: Non-slip.

F. Color and Pattern: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, 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.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.

B. Ensure that concrete slabs, on or below grade, are installed over a permanent effective vapor retarder, respecting current versions of the standard practice ASTM E1643 and the standard specification ASTM E1745. The vapor retarder must be placed directly underneath the concrete slab, above the granular fill, as per Manufacturer’s instructions. The vapor retarder must have a perm rating of 0.1 or less and must have a minimum thickness of 10 mil (0.010 in).

C. Ensure that no concrete sealers or curing compounds have been applied to or mixed into the concrete.

D. Installation of the resilient athletic flooring to be carried out no sooner than the specified curing time of the concrete (normal density concrete curing time is approximately 28 days for development of design strength, having a minimum 3500 psi or 25 MPa in compressive strength).

E. Ensure that concrete surface is free of any contaminant that could inhibit bond (paint, wax, dust, oil or grease, sealer, curing compound, solvent, asphalt, old adhesive residues, etc.). All contaminants must be removed from the surface via mechanical abatement. Use of abatement chemicals is not recommended.

F. Confirm concrete has a smooth finish, proper density and is highly compacted with a tolerance of 1/8th of an inch in a 10-foot radius.

G. Concrete Substrates: Prepare according to ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Alkalinity Testing: Perform pH testing according to ASTM F710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
   3. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

b. Perform tests so that each test area does not exceed 200 s.f., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
c. 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.

H. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

I. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

J. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
1. Do not install flooring until they are same temperature as space where they are to be installed.

K. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

L. Proceed with installation only after unsatisfactory conditions have been corrected.

M. Ensure room and substrate temperatures are maintained prior to moisture testing and flooring installation, during the flooring installation, as well as a minimum of 48 hours after the flooring has been completely installed. Recommended ambient temperature range is between 65 degrees F and 86 degrees F and recommended ambient humidity range is between 35% and 55%.

N. If installing over wood substrates, ensure exterior grade plywood with at least one good side, such as: APA (Engineered Wood Association) Exterior grade plywood (A-A Exterior, A-B Exterior or A-C Exterior). There must be proper underfloor ventilation, plywood must be dry and should have a moisture content ranging between 6 and 12%, when measured with a quality wood moisture meter (electronic hygrometer).

O. Installation of resilient athletic flooring shall be permitted to commence only after the building is enclosed and all other trades have completed their work. It is the General Contractor or Construction Manager’s responsibility to ensure that a secure and clean working area is maintained before, during and after the installation of the resilient athletic flooring.

3.03 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use non-permanent, nonstaining marking device.

E. Install tapered transition edges at exposed edges of tile installations and at all door openings.

F. Install all accessories following Manufacturer's current printed guidelines.

G. Line Marker to paint all lines following Manufacturer's current printed guidelines, respecting the drawing(s) and the Master Specification.

3.04 REPAIRS

A. Repair material must come from the same original dye lot as the Manufactured Product initially installed.

B. When required, Repairs are to be performed by Surfacing Contractor's qualified installers/technicians only.

3.05 CLEANING AND PROTECTING

A. Perform the following operations immediately after completing flooring installation:
   1. Remove adhesive and other blemishes from flooring surfaces.
   2. Sweep and vacuum flooring thoroughly.
   3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

B. Always wait at least a minimum of 72 hours after the resilient athletic roll flooring has been completely installed before performing initial maintenance. Always maintain the resilient athletic flooring following Manufacturer's current printed guidelines.

C. For surfaces having received newly painted lines, wait a minimum of 30 days after the application of the paint to ensure its proper curing before going over the surface with a scrubber/scrubbing the lines.

D. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

E. Preserve the integrity of the installation and protect against direct sunlight/UV exposure; always ensure that windows and glass doors have inherent UV protection and/or are fitted with blinds/ UV film.

END OF SECTION

PART 1 – GENERAL

1.01 SUMMARY

A. Types of Precast Terrazzo work included:
   1. Precast Terrazzo Stair Treads
   2. Setting material, grouts, sealants and caulks
   3. Installation of Precast Terrazzo Stair Treads.

1.02 REFERENCES

A. 28 CFR 36 - Nondiscrimination by Public Accommodations and in Commercial Facilities; Final Rule; Department of Justice; current edition.

B. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2022b.

C. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

D. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

E. ASTM C293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading).

F. ASTM D56 - Standard Test Method for Flash Point by Tag Closed Cup Tester; 2021a.

G. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester; 1993 (Reapproved 2018).

H. NTMA (REF) - Terrazzo Systems Reference Guide; 2021.

I. NTMA (SPECS) - NTMA Terrazzo Specifications; Current Edition.

1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings of all precast terrazzo items showing detail sections and profile for all precast items. Details shall show all reinforcing and special hardware for fastening.

B. Samples:
   1. Submit maximum of 3 samples 3" x 6" size for all colors.
      a. Colors: as selected by the Architect from the manufacturer's full color offering.
   2. Submit two copies of NTMA maintenance literature.
   3. Quality Assurance and Procedure Program.

C. Performance Requirements:
   1. Compressive Strength: 4000 p.s.i.
   2. Flexural Strength: 600 p.s.i.

D. Certification:
   1. Suppliers shall furnish certification attesting that materials meet specification requirements.

1.04 QUALITY ASSURANCE

A. NTMA Standards: Comply with specified provisions and recommendations of the National Terrazzo & Mosaic Association, Inc. (NTMA).

B. Manufacturer's Instructions: In addition to specified requirements, comply with precast terrazzo manufacturer's instructions and recommendations for substrate preparation, materials storage, mixing and application, finishing and curing.

C. Qualifications: Precast Terrazzo Manufacturer and Trade Contractor must have a minimum of 5 years of successful experience on projects of similar magnitude and complexity to that indicated project. Manufacturer and contractor to be prequalified by Architect prior to bidding. Failure to prequalify will void bid.

D. Manufacturer to supply a written Quality Assurance Program and Procedure manual.

1.05 DELIVERY, STORAGE AND HANDLING

A. Packaging and Shipping: Precast terrazzo to be palletized and shrink wrapped, delivered in original unopened packaging with legible manufacturer identification, including size, piece number, quantities, manufacturer date and inspector initials.

B. Storage and Protection: Precast terrazzo to be stored indoors, in a climate-controlled environment, sheltered from moisture in original packaging. Protect from damage by other trades.

C. Report all damage due to shipment immediately. Customer is required to sign the Bill of Lading slip noting damaged product. Picture proof is required.

1.06 WARRANTY

A. Manufacturer/Installer shall warrant installed system for a period of 1 year from date of substantial completion against failure of workmanship and materials.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:
   1. Wausau Tile, Inc.: Atmosphere Series (ETT-1)
   2. Substitutions: See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES and Section 016100 - BASIC PRODUCT REQUIREMENTS.

2.02 MATERIALS

A. Portland Cement: ASTM C150/C150M Specifications for Portland Cement.

B. Aggregates: All aggregates to meet ASTM C33/C33M specifications, cleaned and properly graded to size. Aggregate shall be blended to meet individual project requirements.

C. Marble chips, size to conform with NTMA gradation standards.

D. Coloring; Pigments used shall be inorganic, resistant to alkalinity and used per manufacturer's recommendations.

E. Reinforcement and Hardware:
   1. To conform with NTMA and Manufacturer's design.
   2. Reinforce precast with deformed rods or wire mesh or both as recommended by precast terrazzo manufacturer.

F. Abrasive Inserts: Silica carbide and black epoxy. Specify one to three lines.
   1. Number of Insert Lines: Three (3)

G. Caulks & Sealants:
   1. Polyurethane Sealant - See Section 079200 - JOINT SEALANTS
   2. Color: as selected by the Architect from the manufacturer's full color offering.

H. Cleaner: Liquid neutral chemical cleaner, with pH factor between 7 and 8, of formulation recommended by sealer manufacture for type of precast terrazzo used and complying with NTMA requirements.

I. Sealer: Colorless, slip and stain-resistant penetrating sealer with pH factor between 7 and 8, that does not affect color or physical properties of precast terrazzo surface. Flash point (ASTM D56): 80 degrees F, Minimum.

2.03 MANUFACTURED UNITS

A. Sizing Tolerances:
   1. All units to conform to shop drawings with a 1/16 inch tolerance in dimension.

B. Precast Surfaces and Edges:
   1. All exposed edges to be ground and polished with a minimum of 1/16" bevel.
   2. All finished surfaces to be ground and polished, free of holes and to have overall uniformity in matrix and aggregate.
   3. All precast terrazzo finished surfaces to be sealed with a sealer approved by manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas to receive precast terrazzo for the following:
   1. Defects in existing work.
   2. Deviations beyond allowable tolerances for the substrate.
   3. Start work only when all defects have been corrected by others.

3.02 INSTALLATION

A. Setting:
   1. Setting methods will vary per product. Set accurately as shown on the approved shop drawings. Contact your setting material manufacturer with any questions on proper bonding of all materials.
   2. Setting methods are:
      a. Cement based setting materials: as recommended or specified by the manufacturer for this project after observation by the manufacturer's representative.
      b. Epoxy based setting materials: as recommended or specified by the manufacturer for this project after observation by the manufacturer's representative.
      c. Weld attachment: as recommended or specified by the manufacturer in accordance with the manufacturer's guidelines to achieve the welding requirements specified by the structural engineer for the project.

1) Note: continuous welding will not be permitted when attaching terrazzo to avoid over-heating and cracking of the terrazzo.

3. Thinset materials (cement or epoxy-based) require a full setting bed be applied to all appropriate surfaces of the precast terrazzo, vertical and horizontal, where contact is made with the substrate or structural base.
4. Alignment of precast should be straight and true to all dimensions. Tolerance in length, width or height shall be less than 1/8 inch.
5. Install anchors as shown on approved shop drawings.
6. Fill joints between terrazzo and adjacent materials with backer rod or bond breaker and manufacturer approved sealant.

B. Protection:
   1. Upon completion, the work shall be ready for final inspection and acceptance by owner or owner agent.
   2. General Contractor shall protect the finished work from the time the terrazzo contractor completes the work.

C. Finish: Seal all precast cement terrazzo finished surfaces with a manufacturer-approved sealer product installed in accordance with the manufacturer's recommendations.

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. This Section includes one resinous flooring system with epoxy body.
   1. Application Method: Flat metal or plastic blade, power or hand troweled.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: For each resinous flooring system required, 5 inches (150 mm) square, applied to a rigid backing.

C. Product Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on the Drawings.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. No request for substitution shall be considered that would change the generic type of floor system specified (i.e. Epoxy resin mortar based flooring system, 12% post-consumer glass with urethane sealers). Equivalent materials of other manufactures may be substituted only on approval of Architect/Engineer. Request for substitution will only be considered only if submitted 10 days prior to bid date. Request will be subject to specification requirements described in this section. See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES.

B. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Contractor shall have completed at least 10 projects of similar size and complexity.

C. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer, with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

D. Manufacturer Field Technical Service Representatives: Resinous flooring manufacture shall retain the services of Field Technical Service Representatives who are trained specifically on installing the system to be used on the project.

1. Field Technical Services Representatives shall be employed by the system manufacture to assist in the quality assurance and quality control process of the installation and shall be available to perform field problem solving issues with the installer.

E. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Apply full-thickness mockups on 48-inch (1200-mm) square floor area selected by Architect.
      a. Include 48-inch (1200-mm) length of integral cove base.
   2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion and final color match is visually seamless.

F. Pre-installation Conference:
   1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
   2. Attendance:
      a. General Contractor
      b. Architect/Owner's Representative.
      c. Manufacturer/Installer's Representative.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects. Store material per product data sheet.

C. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
   1. Maintain material and substrate temperature between 65 and 85 deg F (18 and 30 deg C) during resinous flooring application and for not less than 24 hours after application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

D. Concrete substrate shall be properly cured. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring

1.07 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of (1) full years from date of installation, or provide a joint and several warranty signed on a single document by material manufacturer and applicator jointly and severally

warranting the materials and workmanship for a period of (1) full year from date of installation. A sample warranty letter must be included with bid package or bid may be disqualified.

PART 2 PRODUCTS

2.01 RESINOUS FLOORING (SRU-1) & (SRU-2)

A. Acceptable Manufactures,
   1. Stonhard (Basis of Design).
   2. Architect approved equivalent.

B. Product: Subject to compliance with requirements:
   1. Stonhard, Inc.; Stonblend GSI-G®.
   2. Architect approved equivalent.

C. System Characteristics:
   1. Color and Pattern: Cork, Wolf Gray, or as indicated on the drawings
   2. Wearing Surface: smooth Matte finish.
   3. Integral Cove Base: Cork, Wolf Gray, or as selected by the Architect from the manufacturer's full color and pattern offering.
      a. Base Height: 4 inch
   4. Overall System Thickness: 3/16 inch (5 mm).

D. System Components: Manufacturer's standard components that are compatible with each other and as follows:
   1. Primer:
      a. Material Basis: Stonblend Primer.
      b. Resin: Epoxy.
      c. Formulation Description: Two (2) component, 100% solids.
      d. Type: Non-pigmented.
      e. Finish: Standard.
      f. Number of Coats: One (1).
   2. Mortar Base:
      a. Material Basis: Stonblend Mortar.
      b. Resin: Epoxy.
      c. Formulation Description: Four (4) component, 100% solids.
      d. Application Method: Flat Metal or plastic blade trowel.
         1) Thickness of Coat(s): 3/16 inch (5 mm).
         2) Number of Coats: One (1).
      e. Aggregates: Pigmented quartz Blended aggregate and 12% post-consumer recycled colored glass.
   3. Grout Coat:
      a. Material Basis: Stonblend Groutcoat
      b. Resin: Epoxy.
      c. Formulation Description: Two (2) component, 100% high solids.
      d. Type: Clear.
      e. Finish: Standard.
      f. Number of Coats: One (1).
   4. Sealer:
      a. Material Basis: Stonkote CE4.
      b. Resin: Epoxy
      c. Formulation Description: Two (2) component, 100% solids.
      d. Type: Clear.
      e. Finish: Matte.
      f. Number of Coats: One (1).

5. Topcoat:
   a. Material Basis: Stonseal CF7.
   b. Resin: VOC EPA Compliant, Waterborne, Aliphatic Polyurethane.
   c. Formulation Description: Two (2) component 100% high solids.
   d. Type: Clear.
   e. Finish: Matte.
   f. Number of Coats: Two (2).

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1.	Compressive Strength, ASTM C579:	6,000 psi after 7 days.
2.	Tensile Strength, ASTM C307:	1,500 psi.
3.	Flexural Strength, ASTM C580:	2,200 psi.
4.	Flexural Modulus of Elasticity, ASTM C580:	5.0 x 105 psi
5.	Hardness, ASTM D2240:	85 to 90, Shore D.
6.	Impact Resistance, ASTM D2794:	> 160 in. lbs.
7.	Abrasion Resistance, ASTM D4060, CS-17:	0.06 gm max. weight loss.
8.	Flammability, ASTM E648 and ASTM E662:	Class 1
9.	Thermal Coefficient of Linear Expansion:	9 x 10-6 in./in./degree F
10.	VOC Content per ASTM D2369, Method E	
	a. Stonblend Primer:	75 g/l
	b. Stonblend GSI Base:	17 g/l
	c. Stonblend Groutcoat:	52 g/l
	d. Stonkote CE4:	34 g/l
	e. Stonseal CF7:	47 g/l (Method C)
11.	Cure Rate: 12 hours for foot traffic, 24 hours normal operations.	

2.02 ACCESSORY MATERIALS

A. Primer: Type recommended by manufacturer for substrate and body coats indicated. Formulation Description: Stonhard Stonblend Primer, 100% solids.

B. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated. Formulation Description Only if application above grade Stonproof ME7.

C. Patching, Leveling and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

D. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated. Allowances should be included for Stonflex MP7 joint fill material.

PART 3 EXECUTION

3.01 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean and dry substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
   1. Mechanically prepare substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup or Diamond Grind with a dust free system.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates meet the following requirements.
   a. Perform in situ probe test, ASTM F2170. Proceed with application only after substrates do not exceed a maximum potential equilibrium relative humidity of 85 percent.
   b. Perform anhydrous calcium chloride test, ASTM F1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of 6 lb of water/1000 sq. ft. of slab in 24 hours.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations. Allowances should be included for Stonflex MP7 joint fill material, and CT5 concrete crack treatment.

3.02 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
      a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer where required by resinous system, over prepared substrate at manufacturer's recommended spreading rate.

C. Integral Cove Base: Stonblend GSI mortar, apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
   1. Integral Cove Base: As indicated on the Drawings or As selected by the Architect..

D. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using steel finishing trowels or power trowel material using manufacturer's specially designed power trowel blades.

E. Groutcoat: Remove excess unbonded granules by lightly abrading or scraping and vacuuming the floor surface. Mix and apply grout coat with strict adherence to manufacturer's installation procedures and coverage rates.

F. Sealer: Lightly sand or scrape surface to remove any floor surface irregularities. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

G. Matte Finish: Lightly sand or scrape surface to remove any floor surface irregularities. Mix and roller apply mar resistant finish with strict adherence to manufacturer's installation procedures.

3.03 TERMINATIONS

A. Chase edges to “lock” the flooring system into the concrete substrate along lines of termination.

B. Penetration Treatment: Lap and seal coating onto the perimeter of the penetrating item by bridging over compatible elastomer at the interface to compensate for possible movement.

C. Trenches: Continue flooring system into trenches to maintain monolithic protection. Treat cold joints to assure bridging of potential cracks.

D. Treat floor drains by chasing the flooring system to lock in place at point of termination.

3.04 JOINTS AND CRACKS

A. Treat control joints to bridge potential cracks and to maintain monolithic protection.

B. Treat cold joints and construction joints and to maintain monolithic protection on horizontal and vertical surfaces as well as horizontal and vertical interfaces.

C. Vertical and horizontal contraction and expansion joints are treated by installing backer rod and compatible sealant after coating installation is completed. Provide sealant type recommended by manufacturer for traffic conditions and chemical exposures to be encountered.

3.05 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any numbers of times during resinous flooring application require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
   3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.06 CLEANING, PROTECTING, AND CURING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer. General Contractor is responsible for cleaning prior to inspection.

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. Modular, Fusion-bonded Carpet Tile.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
      a. Review delivery, storage, and handling procedures.
      b. Review ambient conditions and ventilation procedures.
      c. Review subfloor preparation procedures.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch (300-mm) long Samples.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.07 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. Carpet Tile: Full-size units equal to 10 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Source Quality: Obtain flooring product materials from a single manufacturer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

B. Ordering: Comply with the 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 protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

E. Comply with the manufacturer’s recommendation for the acclimation of all materials in the space where they will be installed for at least 48 hours prior to the installation unless longer conditioning periods are required by the manufacturer.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

B. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
   1. Testing Results: Conduct and document pre-installation testing as specified by manufacturer in accordance with the latest version of the specified test methods.
      a. Substrate Porosity Testing: ASTM F 3131 – Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.

b. pH testing: ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
c. In-situ Relative Humidity Testing: ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
d. Calcium Chloride Testing: ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emissions Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
e. Surface Moisture Testing: ASTM F 2659 – Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and other Floor Slabs and Screeds Using a Non- Destructive Electronic Moisture Meter.
f. Bond Testing: Conduct testing and document results in accordance with the manufacturer's recommendations.

C. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.11 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, loss of tuft bind strength, loss of face fiber, and delamination.
2. Warranty Periods: (Shaw Commercial)
a. Lifetime Commercial Limited.

PART 2 - PRODUCTS

2.01 **CARPET TILE - SHAW CONTRACT "COLOR AT WORK II - CHROMATONE"** (CPT-1)(CPT-1) **&** (CPT-2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. ShawContract- "Color At Work II" Collection; "Chromatone" Tile - 5T444" ecoworx tile secondary backing.
2. Architect approved equivalent.

B. Color: As selected by Architect from manufacturer's full range.

C. Dye Method: 100% Solution Dyed

D. Pattern: as selected by the Architect

E. Fiber Content: Ecosolution Q100 Nylon.

F. Pile Characteristic: Multi-level Pattern Loop.

G. Gauge: 1/12 inch.

H. Total Thickness: 0.236 inch

I. Average Density: 6,171 oz./per cu. yd.

J. Tile Size: 18 inch x 36 inch Modular Tiles.

K. Tufted Face Weight: 18 oz/ sq. yd.

L. Stitches: 9.5 stitches per inch.

M. Primary Backing: 100% Synthetic.

N. Applied Soil-Resistance Treatment: SSP Shaw Soil protection.

O. General Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm. - Class I
2. Indoor Air Quality: CRI Green Label Plus - GLP9968
3. Methenamine Pill Test (ASTM D2859): Pass.
4. Smoke Density (NFPA-258-T or ASTM E-662): less than 450.
5. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
6. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.
7. ADA Compliance: >0.6, meets the recommended static coefficient of friction for ADA walking surfaces and accessible routes

P. Warranty: Lifetime Commercial Limited.

2.02 **CARPET TILE - SHAW CONTRACT "COLOR AT WORK II - SATURATE"** (CPT-3)

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. ShawContract- "Color At Work II" Collection; "Saturate" Tile - 5T109" ecoworx tile secondary backing.
2. Architect approved equivalent.

B. Color: As selected by Architect from manufacturer's full range.

C. Dye Method: 100% Solution Dyed

D. Pattern: as selected by the Architect

E. Fiber Content: Ecosolution Q100 Nylon.

F. Pile Characteristic: Multi-level Pattern Loop.

G. Gauge: 1/12 inch.

H. Total Thickness: 0.222 inch

I. Average Density: 6,968 oz./per cu. yd.

J. Tile Size: 9 inch x 36 inch Modular Tiles.

K. Tufted Face Weight: 18 oz/ sq. yd.

L. Stitches: 10.0 stitches per inch.

M. Primary Backing: 100% Synthetic.

N. Applied Soil-Resistance Treatment: SSP Shaw Soil protection.

O. General Performance Characteristics:
1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm. - Class I

2. Indoor Air Quality: CRI Green Label Plus - GLP9968
3. Methenamine Pill Test (ASTM D2859): Pass.
4. Smoke Density (NFPA-258-T or ASTM E-662): less than 450.
5. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
6. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.
7. ADA Compliance: >0.6, meets the recommended static coefficient of friction for ADA walking surfaces and accessible routes

P. Warranty: Lifetime Commercial Limited.

2.03 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints. Colors and patterns as selected by the Architect from the manufacturers full color and pattern offering. See drawings for details.

C. Resilient Edge Strips: Strips shall be homogeneous vinyl or rubber composition with a tapered or bull nose edge no less than 1” wide, colored to match flooring or as selected by Architect from standard colors available. See drawings for details.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Wood Substrates: Wood substrates must be double construction with a minimum total thickness of 1 inch. Wood substrates must be rigid, free from movement and have at least 18" of well-ventilated air space below. Forbo products should not be installed over wooden subfloors built on sleepers over on or below grade concrete floors without first making sure that adequate precautions have been taken to ensure the structural integrity of the system, and to prevent moisture migration from the concrete slab.
1. Refer to Division 6 Carpentry Section for wood substrates and wood underlayment.
2. Reference Standard: Comply with the latest version of ASTM F 1482 – Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Surface Preparation:
   1. General: Prepare substrate in accordance with manufacturer's recommendations and ASTM industry standards. Work shall not proceed until all unsatisfactory conditions are corrected to acceptable conditions to the Owner and Architect.
   2. Substrate: Substrates to receive flooring must be structurally sound, rigid, smooth, flat, clean, and permanently dry. The substrates must be free of all foreign materials including, but not limited to, dust, solvent, paint, wax, oils, grease, residual adhesive, adhesive removers, film-forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds, alkaline salts, excessive carbonation or laitance, mold, mildew, and other foreign materials that might affect the rate of moisture dissipation from the concrete, the adhesion of flooring to the concrete or cause a discoloration of the flooring from below.
   3. Concrete Substrate: Concrete substrates shall be cured per the concrete manufacturer’s recommendations. They must have a minimum compressive strength of 3,000 psi and a minimum dry density of 150 pounds per cubic foot.
      a. Refer to Division 03 Concrete Sections for cast-in-place concrete, concrete toppings, and cementitious underlayments.
      b. Reference Standard: Comply with the latest version of ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   4. Wood Substrates: Wood substrates must be double construction with a minimum total thickness of 1 inch. Wood substrates must be rigid, free from movement and have at least 18" of well-ventilated air space below. Forbo products should not be installed over wooden subfloors built on sleepers over on or below grade concrete floors without first making sure that adequate precautions have been taken to ensure the structural integrity of the system, and to prevent moisture migration from the concrete slab.
      a. Refer to Division 6 Carpentry Section for wood substrates and wood underlayment.
      b. Reference Standard: Comply with the latest version of ASTM F1482 – Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring.

E. Substrate Testing: In order to ensure that the moisture condition of concrete substrates is within acceptable limits, it is essential that moisture testing be conducted and documented on ALL concrete substrates regardless of age or grade level, including those where resilient flooring has already been installed. Moisture testing should only be conducted once a stable, conditioned environment has been established in accordance with the latest version of the specified test methods. All other testing types shall be conducted on all substrate types. A diagram of the area showing the location and results of each test should be submitted to the Architect, General Contractor or End User. If at the time of testing the test results exceed the limitations set forth by the flooring manufacturer, the installation must not proceed until the problem has been corrected. The Contractor responsible for the substrate shall be responsible

for the costs associated with analysis of the substrate and subsequent remediation requirements.

1. Surface Moisture Testing: ASTM F2659 – Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and other Floor Slabs and Screeds Using a Non- Destructive Electronic Moisture Meter.
2. In-situ Relative Humidity Testing: ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
    a. Conduct three (3) tests for the first 1,000 square feet (100 square meters) and at least one additional test for each additional 1,000 square feet (100 square meters).
3. Calcium Chloride Testing: ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emissions Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
    a. Conduct three (3) tests for the first 1,000 square feet (100 square meters) and at least one additional test for each additional 1,000 square feet (100 square meters).
4. Substrate Porosity Testing: ASTM F3131 – Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring.
    a. Conduct testing in accordance with the manufacturer’s recommendations in various locations throughout the area where flooring is to be installed. Although the number of tests required may vary, enough tests should be performed to allow an evaluation of the entire area where material will be installed.
    b. Water should penetrate into the substrate within 5 – 10 minutes to be considered acceptable. If water penetrates too rapidly or too slowly, adjustments to the substrate must be made to provide the proper surface profile. Substrates determined to be overly porous, dusty or generally insufficient may need to be primed using a primer according to the manufacturer’s recommendations to regulate the porosity level of the substrate.
5. pH testing: ASTM F710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
    a. Conduct testing at each calcium chloride test location as the calcium chloride tests are removed.
6. Bond Testing
    a. Conduct testing in accordance with the manufacturer’s recommendations in various locations throughout the area where flooring is to be installed. Although the number of tests required may vary, enough tests should be performed to allow an evaluation of the entire area where material will be installed.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.03 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer. Free lay; install carpet tiles without additional adhesive - pressure sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use non-permanent, nonstaining marking device.

G. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to other specification sections for expansion joint covers.

H. Adhere resilient flooring to substrate without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed installation.
   1. Use adhesive applied to the substrate in compliance with the flooring manufacturer's recommendations, including those for proper spreading of the adhesive, adhesive missing and adhesive open and working times.

I. Immediately roll the flooring in all directions using a 100 lb. roller to ensure proper adhesive transfer. Additional rolling is required during adhesive setup to ensure that the material is flat and fully adhered. The use of a three-section wall roller or steel seam roller is required at walls, under toe kicks or anywhere the full weight of a 100 lb. roller cannot access or be applied.

J. Install pattern(s) as indicated on the drawings, parallel to walls and borders.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection and cleaning methods indicated or recommended in writing by carpet tile manufacturer.

D. Remove and legally dispose of protective covering at time of Substantial Completion.

END OF SECTION

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 Resilient cork/linoleum tackable wallcovering and related accessories.

1.03 REFERENCES

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

B. GA-214 - Levels of Finish for Gypsum Panel Products; 2021.

1.04 SUBMITTALS

A. See Section 013300 - SUBMITTALS.

B. See Section 016100 - BASIC PRODUCT REQUIREMENTS.

C. Product Data: Catalog sheets and specifications indicating compliance with specified requirements for the following:
   1. Tac-Wall®.
   2. Adhesive, Primer/Sealer, Caulk.
   3. Metal Molding and other accessories.

D. Color Selection: Submit samples of manufacturer’s standard colors.

E. Samples:
   1. Three (3) Tac-Wall® 7 x 9-inch samples of each type and color of tackable wallcovering material selected.
   2. Metal Molding: Two (2), 12-inch-long pieces.

F. Installatiion Instructions:
   1. Submit manufacturer’s written installation instructions.

G. Contract Closeout Submittals:
   1. Maintenance Data: Deliver two (2) copies covering the installed products, to the Architect.
      a. Include manufacturer’s recommended cleaning materials, application methods, and precautions in the use of materials and methods which would damage the wall covering.

1.05 QUALITY ASSURANCE

A. Installer’s Qualifications: The persons installing the wall covering and their Supervisor shall be experienced in wall covering installation and regularly employed by a company engaged in the installation of wall coverings for a minimum of five (5) years.
   1. Furnish to the Architect the names and addresses of five (5) similar projects which the forgoing people have worked on during the past three (3) years.

B. Surface Burning Characteristics Classification: Provide materials that meet classification ratings below:

1. ASTM E84 - (Flame Spread and Smoke Developed): II/B.

C. Single Source Responsibility: Obtain tackable wallcovering system components from a single approved source.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store materials in the manufacturer's original, unopened packages or containers, clearly labeled to identify manufacturer, brand name, quality or grade, and flammability and smoke developed classifications and numbers.

B. Store wall covering materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, and extreme temperatures. Maintain room temperature within the storage area maintained above 55°F (13°C) with normal humidity.

C. Do not store wall covering in an upright position (on end).

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Comply with manufacturer's written recommendations as to environmental conditions under which wall coverings can be applied.

B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 55°F (13°C) unless required otherwise by manufacturer's instructions.

C. Apply adhesive when substrate surface temperature and ambient temperature is above 55°F (13°C) and relative humidity is below forty percent.

D. Maintain constant recommended temperature and humidity for at least 72 hours prior to and throughout the installation period, and for 72 hours after wallcovering installation completion.

E. Provide not less than 80-foot-candles per square foot lighting level measured mid-height at substrate surfaces.

1.08 WARRANTY

A. Submit manufacturer's limited ten (10) year written warranty.
1. Tackable wallcovering shall be warranted not to crack, chip, or peel, to resist staining and yellowing, and to show no appreciable fade when thoroughly cleaned and maintained.

PART 2 PRODUCTS

2.01 TACKABLE WALLCOVERING (WTS-1)

A. Manufacturer:
1. Koroseal Interior Products, 3875 Embassy Parkway, Suite 110, Fairlawn, OH 44333. Phone: (855) 753-5474.
2. Architect approved equivalent.

B. Product:
1. Walltalkers® Tac-Wall® (WTS-1)
a. Uni-color, resilient, homogeneous, tackable linoleum surface consisting of linseed oil, granulated cork, rosin binders, and dry pigments calendered onto natural burlap backing. Color shall extend through thickness of material.
b. Size: 48-inch-wide rolls.
c. Gauge: 1/4 inch.

2. Adhesive/Primer
   a. Solvent free, SBR type linoleum, Heavy-duty clear or clay based premixed vinyl adhesive as recommended by wallcovering manufacturer.
   b. Substrate Primer/Sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings.
3. Caulk
   a. Color-matched caulk from wallcovering manufacturer.
4. Trim for Tac-Wall®
   a. J-Trim: JT12-00: Clear Satin, anodized aluminum, ¼ inch trim.
   b. Inside Corner Trim: Clear Satin, anodized aluminum.
   c. Outside Corner Trim: Clear Satin, anodized aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive wall covering for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Protection: Prior to surface preparations and wall covering application remove switch plates, wall plates, surface-mounted fixtures, and all other comparable items.

B. Surface Preparation:
   1. Perform preparation and cleaning procedures in accordance with wall covering manufacturer's instructions and as specified.
   2. Remove dirt, grease, old adhesive, loose paint, and plaster from wall. Fill cracks, crevices, and holes with spackling. Sand rough spots smooth and flush with adjacent surfaces.
   3. Gypsum Wallboard: Recess nails and screws. Repair irregular tape joints, sand and remove dust. Apply primer/sealer and allow to dry.
   4. Plaster: Do not apply primer/sealer until moisture content is less than 8 percent as determined with electronic moisture meter. Remove crystals due to efflorescence. Apply primer/sealer and allow to dry.
   5. Concrete and Concrete Unit Masonry: Coat surface with 1/8 to 1/4 inch thickness of gypsum or Portland cement plaster or special masonry filler (block filler) and trowel smooth.
   6. Painted Surfaces: Remove loose paint. Dull surfaces of enamel and gloss paints, and rinse with clear water.

3.03 APPLICATION OF TACKABLE WALLCOVERING

A. Handle and apply wall covering in accordance with manufacturer's instructions.

B. Permanent HVAC should be set to 68 degrees Fahrenheit for at least 72 hours prior to, during, and after installation.

C. Install with permanent lighting on.

D. Place wall covering panels consecutively in the order they are cut from rolls, including spaces above or below openings.

E. Apply adhesive with a 1/16-inch square notch trowel to the area to receive the sheet (apply enough for one sheet at a time). Apply a uniform coat of heavy-duty pre-mixed clay-based or extra strength clear wallcovering adhesive.

F. Install each strip horizontally and in the same sequence as cut from the roll with seams vertical and plumb, and at least six inches away from any corner unless noted otherwise.

G. When covering the entire wall, seam the material out of the main writing and viewing areas of the wall.

H. Remove excess adhesive immediately after the wallcovering is applied. Clean entire surface with a warm mild soap solution, and clean soft cloths. Rinse thoroughly with water and let dry before using. Change water often to maintain water clarity.

I. Replace items removed prior to commencing work, as noted in PREPARATION article above, to their original locations and orientations.

3.04 INSTALLATION OF METAL MOLDING

A. Install with molding adhesive and fasteners in accordance with the molding manufacturer's recommendations and instructions.

B. Miter corner bead molding at head/jamb intersections.

3.05 ADJUSTING AND CLEANING

A. Clean tackable wallcovering in accordance with manufacturer's written instructions.

B. Upon completion of the Work, remove surplus materials, rubbish and debris resulting from installation of wall covering.

END OF SECTION

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. - (FWPS-1)
   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 SECTION INCLUDES

A. Fabric-covered fiberglass core wall panels and mounting accessories.

B. Fabric-covered fiberglass core ceiling baffles.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

D. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2016.

1.03 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel sizes, shapes and layouts, color and texture schedule and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available .

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016100 - BASIC PRODUCT REQUIREMENTS, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than ten years of experience in manufacturing acoustical products similar to those specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation.

B. Store panels flat, in dry, well-ventilated space; do not stand panels on end.

C. Protect panel edges from damage.

1.06 MOCK-UP

A. See Section 014500 - QUALITY CONTROL, for additional mock-up requirements.

B. Construct mock-up of acoustical panels at location indicated by Architect/Engineer.
   1. Minimum mock-up dimensions; 96 by 96 inches (2440 by 2440 mm).
   2. Approved mock-up may remain as part of the Work.

1.07 WARRANTY

A. Provide manufacturer's 1-year limited warranty covering defects in materials and / or factory workmanship for Acoustical canopy ceiling systems.

B. Provide manufacturer's 1-year limited warranty covering defects in materials and / or factory workmanship for Acoustical wall systems.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fabric-Covered Acoustical Panels:
   1. Armstrong World Industries, Inc: SOUNDSCAPES Blades Linear Acoustical Panels www.armstrong.com.
   2. Architect approved equivalent.
   3. Substitutions: 012500 - PRODUCT SUBSTITUTION PROCEDURES

B. Provide all Linear Acoustical Panels by one manufacturer.

2.02 FABRIC-COVERED LINEAR ACOUSTICAL CEILING PANELS (ACB-2)

A. Linear Ceiling Panels: Prefinished, factory assembled fabric-covered panels.
   1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   2. Light reflectance: 0.90 (White).
   3. Other Linear Panel Characteristics:
      a. Washable
      b. Scratch Resistant
      c. Soil Resistant
      d. 71% Recycled content

B. Fiberglass Core Panels:
   1. Density: 7 to 10 lb/cu ft (112 to 160 kg/cu m).
   2. Noise Reduction Coefficient (NRC): 1.15 (6 inch Blade spacing) when tested in accordance with ASTM C423.
   3. Panel Thickness: 2 inches and as indicated on the drawings..
   4. Panel Height: 10 inches and as indicated on the drawings.
   5. Panel Height: 10 inches and as indicated on the drawings.
   6. Edges: Perimeter edges - Square with Durabrite scrim on all sides.
   7. Corners: Square.
   8. Mounting: Direct to Grid Suspension System.
   9. Seismic Restraint: Contractor shall refer to ASCE 7, Section 13.5, Architectural Components for seismic requirements.

C. Fabric Covering: Seamless fabric facing material, for stretched covering of core material.
   1. Fabric: Durabrite scrim on all sides with finished square edges..
   2. Color(s): White, Sky, Lagoon, Tangerine, and as indicated on the drawings..

2.03 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
   1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
   2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.04 ACCESSORIES

A. Provide Main Beam, Cross Tees, wall angle moldings and other accessories to complete the installation of Linear Acoustic Baffle systems in accordance with the manufacture's specifications, instructions and recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical Linear Baffles. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical Linear Baffles in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

B. Install Acoustical Linear Baffles in strict accordance with the manufacturers installation instructions. Provide minimum clearances between panels.

C. Coordinate Linear Baffles locations with the fire sprinkler and fire / smoke detection systems to insure that these systems shall comply with NFPA 13 and local codes where they are included in the work of the project. Failure to coordinate this work may cause field adjustments to be required in order to obtain final approvals of these systems accordingly which shall be done at no additional cost to the Owner.

D. Ceiling Linear Baffles shall be handled and installed by a team of at least two persons in accordance with the manufacturers instructions.

E. Linear Baffles edge protectors shall remain in place until panel is installed. Field painting shall not be permitted. Damaged or scuffed panels shall be replaced with new panels at no additional cost to the Owner.

F. Install panels to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
   1. Plumb and level.
   2. Spacing of Linear Panels.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.04 PROTECTION

A. Provide protection of installed acoustical wall panels and suspended canopies until completion of the work.

B. Replace Linear Baffles that cannot be cleaned and repaired to satisfaction of the Architect/Engineer.

END OF SECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions 01 Specification sections apply to work of this section.

1.02 SUMMARY

A. Section Includes:
   1. Cementitious wood fiber plank acoustical wall and ceiling system

B. Alternates
   1. Prior Approval: Unless otherwise provided for in the Contract documents, proposed product substitutions may be submitted no later than TEN (10) working days prior to the date established for receipt of bids. Acceptability of a proposed substitution is contingent upon the Architect's review of the proposal for acceptability and compliance with the basis of design.
   2. Submittals that do not provide adequate data for the product evaluation will not be considered. The proposed substitution must meet all requirements of this section, including but not necessarily limited to, the following: Single source materials suppliers (if specified in Section 1.5); Panel design, size, composition, color, and finish; Suspension system component profiles and sizes; Compliance with the referenced standards.

1.03 REFERENCES

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASHRAE Std 62.1-2019 - Ventilation for Acceptable Indoor Air Quality; 2019, with Errata and Amendments (2021).

C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

G. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2022.

H. ASTM E2768 - Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials

I. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

K. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers; 2017, v1.2.

L. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2015).

M. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. L.E.E.D. - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings

P. International Well Building Standard

Q. Mindful Materials

R. Living Building Challenge

S. U.S. Department of Agriculture BioPreferred program (USDA BioPreffered).

1.04 SYSTEM DESCRIPTION

A. Direct attached acoustical ([]) systems manufactured from domestic cementitious wood fiber.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data for each type of Tectum® Direct-Attached™ ceilings or walls required.

B. Samples: Minimum 6 inch x 6 inch samples of specified Tectum® Direct-Attached interior panels.

C. Shop Drawings: Layout and details of Tectum® Direct-Attached interior panels show locations of items that are to be coordinated with the installation as required.

D. Certifications: UL certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. Acoustical performance, products must be tested to the A, D-20, C-20, or C-40 method.

E. Country of Origin: Submittals must be accompanied by letter, label or certification indicating the manufacturing country of origin. Comply with Made in USA requirements as applicable for the project.

F. Provide materials with an Underwriter's Laboratory classification of acoustical performance as specified in this Section.

1.06 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate UL markings.

1. Surface Burning Characteristics: Tested per ASTM E84 and complying with ASTM E1264 Classification.
    a. Tectum® Direct-Attached, as with other architectural features located at the ceiling, may obstruct or skew the planned fire sprinkler water distribution pattern through possibly delay or accelerate the activation of the sprinkler or fire detection systems by channeling heat from a fire either toward or away from the device. Designers and installers are advised to consult a fire protection engineer, NFPA 13, or their local codes for guidance where automatic fire detection and suppression systems are present.
    b. Coordination of Work: Coordinate acoustical ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.07 DELIVERY, STORAGE & HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Provide labels indicating brand name, style, size and thickness.

C. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

D. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.08 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
    1. Do not install ceiling panels until building is closed in and HVAC system is operational.
    2. Locate materials onsite at least 72 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
    3. Maintain the following conditions in areas where acoustical materials are to be installed 72 hours before, during and after installation:
        a. Relative Humidity: 25 - 85%.
        b. Uniform Temperature: 32 - 120 degrees F (0 - 49 degrees C).

1.09 WARRANTY

A. Tectum® Direct-Attached Wall and Ceiling Panels: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
    1. Defects in materials or factory workmanship.
        a. Tectum® Direct-Attached Wall and Ceiling Panels warranty - Thirty (30) years from date of substantial completion.

1.10 MAINTENANCE

A. Extra Materials: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
    1. Tectum® Direct-Attached Wall and Ceiling Panels: Furnish quality of full-size units equal to 5.0 percent of amount installed.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Tectum® Direct-Attached Wall or Ceiling Panels:
   1. Tectum® by Armstrong World Industries, Inc.
   2. Architect approved equivalent.

B. Suspension System and Accessories:
   1. 1. Armstrong World Industries, Inc.
   2. Architect approved equivalent.

2.02 TECTUM® DIRECT-ATTACHED CEILING PANELS

A. Acoustical Panels Type AP-5:
   1. Surface Texture: Coarse
   2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
   3. Finish: Surface appearance shall be consistent from panel to panel
   4. Color: Natural and Custom color as selected by the Architect
   5. Size: Standard: 23 ¾" x 48"(23 ¾" x 48", 23 ¾" x 96", 47 ¾" x 96") Custom Sizes (width 23 ¾" – 48"; length 12" – 144" – Ceilings are limited to 12" -96" lengths if touching adjacent panels)
      a. Standard: 23 ¾" x 96".
   6. Thickness:
      a. Standard: 1 inch.
   7. Long Edge Profile: Bevel
   8. Short Edge Profile: Square
   9. UL Classified Noise Reduction Coefficient (NRC): ASTM C423, Classified with UL label.
      a. Mounting A: 0.40
   10. UL Classified Flame Spread: ASTM E 1264; Class A. Product must be able to meet this criteria after being painted six times.
   11. Light Reflectance (LR) White Panel: ASTM E 1477; 0.75
   12. Dimensional Stability/Mold Resistance: HumiGuard Plus and no significant mold growth when tested by ASTM D3273.
   13. USDA Certified Biobased Product, 98%
   14. Acceptable Product: Tectum® Direct-Attached as manufactured by Armstrong World Industries
      a. Item(s): 8181T10TWH and 8181T10TNA as selected by Architect.

2.03 METAL SUSPENSION SYSTEMS

A. Accessories:
   1. #6 x 1-5/8" Painted Head Sharp Point Screws, item 8187L16
   2. #6 x 1-5/8" Painted Head Drill Point Screws, item 8188L16
   3. 2-1/4" Painted Head CMU Screws, item8189L22

B. Suspension Components for Alternative Direct Attach – by Method of Armstrong Drywall Suspension
   1. Drywall Grid main beam item HD8906
   2. Drywall Grid cross tees item XL8945
   3. Perimeter angle item KAM 12
   4. 1-5/8" sharp point screws item 8187L16

C. Attachment Component for Direct Attached to Heavy gauge metal steel

1. 1-5/8" drill point screws item 8188L16

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Measure each wall area and establish layout of wall units. Coordinate panel layout with mechanical and electrical fixtures.

B. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
   1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.03 INSTALLATION

A. Install Tectum® Direct-Attached Panels in accordance manufacturer's installation instructions.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken Tectum® Direct-Attached Panels.

B. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove any Tectum® Direct-Attached Ceiling Panels that cannot be successfully cleaned and or repaired. Replace with attic stock or new product to eliminate evidence of damage.

END OF SECTION

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 the work of this Section.

1.02 SUMMARY

A. Section Includes:
   1. Wood Veneer Acoustical sound absorptive panels.

1.03 SUBMITTALS

A. Comply with Section 013300 - SUBMITTAL PROCEDURES.

B. Product Data: Manufacturer’s technical data and installation instructions for each type of wall panel required.

C. Certifications: Certified test reports showing compliance with performance requirements specified.

D. Samples: Submit a minimum of three (3) samples of each panel type and finish type required. Include samples that show the range of variation expected in grain, texture and color.

E. Shop drawings: Submit shop drawings showing overall layout with dimensions and details of penetrations and intersections with other materials or building components.

F. Submit operation and maintenance data for installed products. Include precautions relating to harmful cleaning materials and methods that would affect the service life of the panels.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Provide acoustic wall panels from a single Manufacturer with at least two (2) years of prior experience fabricating projects of similar size and complexity.

B. Installer: Installation shall be done by qualified Carpenters experienced in the installation of architectural woodwork. Installers must receive training on handling, cutting, machining and field finishing the specified product prior to receiving materials on site.

C. Fire Performance Characteristics: Class A as tested by an independent accredited testing facility. Tests: ASTM E84- Flame spread: 25 or less - Smoke developed: 450 or less as specified by State or local codes.

D. Coordination of Work: Installing contractor shall organize and conduct a pre-installation survey of temperature, humidity, and construction elements attaching, penetrating, or concealed behind the acoustic wall panels.

E. Acoustic wall panels to be manufactured from no less than 67 percent post-industrial recycled materials by weight.

1.05 REFERENCES

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

B. ASTM D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials; 2012 (Reapproved 2020).

C. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings; 2020.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver panels to the project in original, unopened packages. Inspect containers for visible damage and report any questionable condition to the shipper and manufacturer immediately.

B. Store products in a fully enclosed, clean, dry space, off the ground, out of direct sunlight and protected from damage with temperature controlled between 50 and 86 degrees F.

C. Handle products carefully to avoid damaging panel surfaces or chipping edges. Report any damage immediately. Do not install damaged panels, they are not covered by the manufacturer’s warranty.

1.07 PROJECT CONDITIONS

A. Do not install acoustic wall panels until space is enclosed and weather-proofed, wet work is completely dry, all dust producing work is complete, and ambient temperature and humidity conditions are maintained at the levels required by the manufacturer.

B. Permit panels to reach room temperature, 68 to 80 degrees F, and stabilized moisture content of 35% to 55% RH for at least 72 hours before installation per AWI standards. Building should be enclosed and HVAC systems functioning in continuous operation with relative humidity maintained between 35 and 55 percent.

1.08 WARRANTY

A. Provide manufacturer’s standard one-year written product warranty per Section 017800 - CLOSEOUT SUBMITTALS.

1.09 MAINTENANCE

A. Maintenance Instructions: Provide manufacturers standard maintenance and cleaning instructions for finishes provided.

B. Extra Materials
   1. Deliver three (3) small panels and two (2) large panels complete with concealed mounting hardware for extra stock.
   2. Extra materials shall be from the same production run as the original materials.
   3. Extra materials shall remain in the manufacturer’s original unopened packaging and stored in a fully enclosed, clean, dry space out of direct sunlight and protected from damage with temperature controlled between 50 degrees F and 86 degrees F. Clearly mark packages “Small Acoustical Panels” and “Large Acoustical Panels”.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide wall system utilizing “QUADRILLO”, QPP-19 (1 1/8 inch)(NRC 0.70) - F5 Mounting, as manufactured by Decoustics., 61 Royal Group Crescent, Woodbridge, Ontario, L4H 1 X9 Canada. Tel.: (800) 367-3809.

B. Architect approved equivalent meeting all acoustical, dimensional, veneer, concealed attachment and color requirements of the specified acoustical panels.

2.02 MATERIALS (AWP-1)

A. QUADRILLO; QPP-19 (1 1/8 inch)(NRC 0.70) - F5 Mounting, for interior installation, acoustical or decorative panels as follows: A natural wood veneer with v-groove architectural face laminated to a high performance acoustical core. Core material is made from a no-added urea formaldehyde MDF material. Open area of the panels is approximately 4%.

B. Panel Perforations: Open area of the panels is approximately 4%. The perforations must be clean, without rounded edges or grain pull out between perforations. A minimum of 99.5% of the perforations must be acoustically functional. Perforations must maintain consistent diameter through the face and backer, with no tapering or roughness.

C. Panels Edge Treatment: Panels will be edge banded with the matching veneer finish.

D. Veneer:
   1. Species: as selected by the Architect from manufacturer's full species offering. and Stain finish in color as selected by the Architect from the manufacturer's full color offering.
   2. Surface Sheen: as selected by the Architect from the manufacturer's full offering of surface sheens available.
   3. Cut: Quarter Sliced (standard).
   4. Matching veneer leaves: Slip Matched (Standard).
   5. Finishes shall be applied in the shop: Clear

E. V- Groove width: 3mm.

F. Rib Width: 5 mm.

G. Groove direction: Vertical

H. Groove spacing: 5mm or 10mm as indicated or scheduled on the drawings.

I. Panel Reveals: Open with ___ inch reveals.

J. Panel Weight: QPP -25 panels: 3.5 lbs/sq. ft. (panels only).

K. Panel Sizes: See contract drawings for acoustical panel sizes and locations.

L. Curved Panels:
   1. Minimum outside curve radius: 16 inches.
   2. Minimum Inside curve radius: 24 inches.

M. Flame Resistance: Class A rating based on ASTM E84 Standard Test Method for Surface Burning Characteristics in Building Materials. Some veneer species and other face materials

may not achieve an overall Class A rating. Check with local building codes for requirements or exemptions.

N. NRC Performance: Noise Reduction Coefficient for acoustical panels to be no less than the NRC listed in this section when using Type F5 mounting.

O. STC Performance: Sound Transmission Class to be no less than 37 using ASTM Test Method ASTM E336.

P. Panel Stability: Linear contraction or expansion to not exceed 0.4% maximum variation in width or height per ASTM D1037.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Inspect installation area and conditions under which work is to be performed for compliance with all manufacturers' environmental requirements. All wet work in the installation area must be complete, cured and dry prior to installation. Do not proceed until all unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Installation must be done by qualified carpenters experienced in the installation of architectural woodwork. The firm must demonstrate successful experience installing materials of similar type and quality of those required for this project. The use of proper carpentry tools and techniques will be required for the installation. Panels to be installed plumb and level.

B. Comply with manufacturer's instruction and recommendations for installation of wall panels consistent with industry standards.

C. Confirm all field dimensions are coordinated with shop drawings.

D. Coordinate the exact size, location and sequencing of panels including penetrations with all building components.

E. Lay out wall panels per approved shop drawings. Report any interferences or deviations before proceeding. Note: Panels installed monolithically will have kerfed edges with splines to level panel faces. Panels have machined edges to simulate the 3mm v-groove when butted against each other.

F. Final installation of acoustical panels shall be just before substantial completion. Once installed, protect panels from dirt and damage.

3.03 ADJUSTING AND CLEANING

A. Clean soiled surfaces of wall panels per manufacturer's instructions.

B. Remove and replace damaged or discolored materials not in compliance with manufacturer's tolerances.

C. Adjust panels after final installation so that surfaces are aligned with gaps or reveals between units straight and consistent in width.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels and modules.

B. Mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2016.

D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

E. NFPA 70-2008 - National Electrical Code; 2008.

F. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 SUBMITTALS

A. See Section 013300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

E. Manufacturer's Qualification Statement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016100 - BASIC PRODUCT REQUIREMENTS, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one carton of each type. One Carton contains four panels.
      a. Furnish Extra Materials from same production run to verify run for color.
      b. Package replacement materials with protective covering, identified with appropriate labels.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with not less than 5 years experience in installation of products similar in complexity to those required for this Project, including specific requirements indicated.
   1. Successfully completed not less than 5 comparable scale projects.

B. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

C. Single Source Responsibility: Obtain the following units for entire Project from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Storage and Protection: Comply with manufacturer's recommendations.
   1. Store products in a cool, dry place out of direct sunlight.
   2. Protect from elements and from damage.

C. Protect edges from damage.

1.06 WARRANTY

A. Provide executed copy of the manufacturer's five (5) year Warranty covering manufacturing defects, workmanship, color irregularities, shipping damage and other instances noted in the Warranty to the Owner as part of Project Closeout documentation.

PART 2 PRODUCTS

2.01 FELT (PET) BASED SOUND ABSORBING MODULES (SAWP-2)

A. Manufacturers:
   1. Turf Design
   2. Architect approved equivalent.
   3. Substitutions: See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES.

B. General
   1. Prefinished, factory assembled fabric-covered modules.
   2. Acoustic Foam with PET Fabric covering.
   3. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. PET Fabric-Covered Acoustical Modules for Walls:
   1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
      a. Facing: 1/16 inch (1.6 mm) impact-resistant and tackable PET surface laminated to core.
   2. Modules Size: as indicated on the drawings.
   3. Modules Shape: Hexagonal and as indicated on the drawings
   4. Panel Thickness: as indicated on the drawings.
   5. Corners: Square.
   6. Fabric: PET.
   7. Color: As selected by Architect/Engineer from manufacturer's full range.
   8. Mounting Method: Direct applied with adhesive.

2.02 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:
   1. Sonus North America; T: 888-287-4183; E: sales@sonusna.com
   2. Substitutions: See Section 016100 - Product Requirements and Section 012500 - Substitution Request Procedures.

B. General:

1. Prefinished, factory assembled fabric-covered panels.
2. Fiberglass core of 6-7 pcf plus 1/8” 16 lb fiberglass with Acoustical custom profiled design pattern on face, with hardened edges, seamless finish material wrapped and bonded to back side of panels.
3. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Walls and Ceilings:
1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
   a. Facing: 1/16 inch (1.6 mm) impact-resistant and tackable surface laminated to core.
2. Noise Reduction Coefficient (NRC): 0.83 to 1.05 when tested in accordance with ASTM C423 for Type _____ mounting, per ASTM E795.
3. Panel Size: As indicated on the drawings.
4. Panel Shapes: as indicated on the drawings
5. Panel Thickness: As indicated on the drawings.
6. Panel Weight: 1 inch = .8 lbs./sq. ft. and 2 inch = 1.5 lbs. / sq. ft.
7. Edges: Perimeter edges reinforced by a formulated resin hardener.
8. Edge Profile: As selected by the Architect
9. Corners: As detailed.
10. Fabric: Woven polyester. Manufacturer’s standard is Guilford of Maine, Anchorage 2335 and Broadcast #2758. See drawings for additional information.
11. Color: As selected by Architect/Engineer from manufacturer's full range.
12. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
13. Mounting Method: Z-Clip mounted and as indicated on the drawings.

2.03 MELAMINE FOAM SOUND-ABSORBING UNITS

A. Manufacturers:
1. Pinta Acoustic Inc; Sonex TEC WEDGE: www.pinta-acoustic.com/#sle.
2. Substitutions: See Section 016100 - Product Requirements.

B. Melamine Foam Acoustical Panels for Walls and Ceilings: Open cell melamine-based foam.
1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Density: 0.5 to 0.7 lb/cu. ft. ASTM D3574.
3. Noise Reduction Coefficient (NRC): 0.85 (2 inch) when tested in accordance with ASTM C423 .
4. Panel Size: 24 inches by 48 inches.
5. Panel Thickness: 2 inches
6. Surface Pattern: Wedge shapes.
7. Color: Black (HPC)
8. Microbial Growth: Passes UL 181, section 11 .
9. Fungus Resistance Rating: #0 per ASTM G21.
10. Mounting: Direct applied with water-based construction adhesive (AcouSTIC).

2.04 THERMOFORMED PLASTIC SOUND-ABSORBING UNITS

A. Manufacturers:
1. Lamvin; Pyramid Diffuser: www.lamvin.com/#sle.
2. Substitutions: See Section 016100 - Product Requirements.

B. Thermoformed Copolymer Plastic Acoustical Panels for Walls and Ceilings:
1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2. Noise Reduction Coefficient (NRC): _____ when tested in accordance with ASTM C423 for Type _____ mounting, per ASTM E795.
3. Panel Size: 24 inches by 24 inches (610 mm by 610 mm).
4. Surface Pattern: Pyramid shapes.
5. Mounting: Back-mounted with mechanical fasteners.

2.05 PREFORMED ACOUSTIC FOAM UNITS

A. Manufacturers:
1. Pinta Acoustic Inc; SONEX TEC WEDGE: www.pinta-acoustic.com/#sle.
2. Architect approved equivalent.
3. Substitutions: See Section 016100 - Product Requirements.

B. Melamine Foam Acoustical Panels for Walls and Ceilings: Open cell melamine-based foam.

2.06 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.07 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect installation area and conditions under which work is to be performed for compliance with all manufacturer’s environmental requirements. All wet work in the installation area must be complete, cured and dry prior to installation. Do not proceed until all unsatisfactory conditions have been corrected.

B. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Provide installation by a qualified contractor with 2 years experience in the installation of acoustic treatment or acoustic ceilings. The firm must demonstrate successful experience installing materials of similar type and quality of those required for this project.

B. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

C. Confirm all field dimensions are coordinated with approved shop drawings.

D. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

E. Suspend ceiling baffles at locations and heights as indicated.

F. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
   1. Plumb and level.
   2. Flatness.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect/Engineer.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Blade Surfaces

B. Plug Surfaces

C. Folded Plug Surfaces

D. Profile Surfaces

E. Profile Plus Surfaces

F. Folded Surfaces

G. Textured Surfaces

H. Stacked Surfaces

I. Overlap Surfaces

J. Line Surfaces

K. Carved Surfaces

L. Cork Surfaces

M. Covering Surfaces

1.02 REFERENCES

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.

D. NFPA 705 Recommended Practice for a Field Flame Test for Textiles and Films.

E. SIN 722-06 Flammability Requirements for Fire Retardant Trees and Plants.

F. Title 19 California State Fire Marshal minimum requirements for flame resistance products identified in Section 13115, California Health and Safety Code.

G. NF X 70-100 (1986, Tube Furnace Method) Fire Test for Analysis of Pyrolysis and Combustion Gasses. Evaluation of Toxic Fumes.

1.03 SUBMITTALS

A. Product Data: Submit Data sheet or Manufacturer Documentation for each product showing dimensions, materials, and colors.

B. Shop Drawings: Submit shop drawings of site plans showing details of construction, product configuration, and related construction.

C. Verification Samples: Submit samples of each chosen material and color.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical components and installation components by a single manufacturer.

B. Coordination of Work: Coordinate acoustical component work with installers of related work including, but not limited to light fixtures, mechanical systems, electrical systems, and sprinklers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical components to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing, allow acoustic components to gradually reach room temperature and a stabilized moisture content.

C. Handle acoustic components carefully to avoid damage.

1.06 PROJECT CONDITIONS

A. Space Enclosure:
   1. Acoustical Components: All wet work must be complete and dry prior to installation. Installation shall be carried out where the temperature is between 60 degrees F and 100 degrees F. These temperature conditions must be maintained for optimal component lifespan.

1.07 WARRANTY

A. Acoustic Room Component: Submit a written manufacturer warranty, agreeing to repair or replace acoustical components that fail within the warranty period. Failures include, but are not limited to:
   1. Acoustical Room Component: Manufacturer’s defects

B. Warranty Period:
   1. Acoustical Room Component: Refer to manufacturer’s standard warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Accepted Manufacturer: CSI Creative.
   Location: 9901 W 74th St, Eden Prairie, MN 55344
   Phone: 800-213-0653
   Email: info@csicreative.com
   Web Address: www.csicreative.com

B. Substitutions: See Section 012500 - SUBSTITUTION REQUEST PROCEDURES.

2.02 SOUND ABSORBING SURFACES (SAWP-1)

A. Basis-of-Design:
   1. Stacked Surfaces 034 (SUR-STK-034) by CSI Creative www.csicreative.com
   2. Materials
      a. Felt: PoshFelt® 100 percent wool, 1/8 inch (3mm) design felt, 100 percent biodegradable. See drawing for multiple layers required.
      b. Acoustic Substrate: Soundcore® 100 percent recyclable, 1/2 inch (12mm) PET, 60 percent recycled content. Provide Soundcore Wood Textures where indicated on the drawings.
      c. Artificial Greenery: ThermaLeaf® Inherently Flame Retardant Foliage. ThermaLeaf® artificial foliage is a proprietary formulation and manufacturing process whereby the fire retardants are impregnated directly into the raw materials of the foliage resulting in an inherently fire retardant “IFR” product.
         1) ASTM E84: Pass
         2) NFPA 701: Pass
         3) NFPA 705: Pass
         4) SIN 722-06: Pass
         5) California Title 19: Pass
         6) NF X 70-100: Pass
      d. Contains no formaldehyde, chemical irritants, or harmful substances.
      e. VOC info: VOC Free, Berkeley Analytical Certificate ID 190313-01
   3. Panel Thickness: 1 1/8 inches, 1 1/4 inches, and as indicated on the drawings.
   4. Panel Size: 48 inches by 108 inches or as indicated on the drawings.
   5. Felt Color: as selected by the Architect from the manufacturer's full color range.
   6. Acoustic Substrate Color: as selected by the Architect from the manufacturer's full color range.
   7. Edge: Exposed Edge.
   8. Attachment Method: Z-Clip.
   9. Properties:
      a. Acoustic Performance: NRC (ASTM C423): 0.45, 1.55, and --- varies by design.
      b. Burning Characteristics: ASTM E84, Class A

PART 3 - EXECUTION

3.01 EXAMINATION

A. Proceed with installation only when all wet work is completed, and unsatisfactory site conditions have been corrected.

B. INSTALLATION
   1. Clean substrates and attachment points of dirt, oils, and other substances that could cause issues during installation.
   2. Install units in accordance with manufacturer's instructions and approved submittals.

C. ADJUSTING AND CLEANING
   1. Replace damaged or broken components.
   2. Adjust units for proper position, uniform appearance and operation.
   3. Clean exposed and semi-exposed surfaces using materials acceptable to the manufacturer.
   4. Maintenance of components should consist of:
      a. Blot spills from material quickly. Wipe with a damp cloth. If stain persists, apply small quantities of carpet or upholstery shampoo solution with a damp cloth (test on inconspicuous location first). Blot well with a clean cloth after each application. Avoid

excessive amounts of water. Ensure adequate ventilation if the product is subject to excessive moisture.

D. WASTE MANAGEMENT
   1. Waste Management
      a. Coordinate recycling of waste materials with Section 017419 - Construction Waste Management and Disposal.
      b. Collect recyclable waste and dispose of or recycle field generated construction waste created during demolition, construction or final cleaning.
      c. Remove recycling containers and bins from site.

E. PROTECTION
   1. Protect finished installation from dust and damage from subsequent and ongoing construction activity.

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. Concrete.
   2. Concrete masonry units (CMU).
   3. Galvanized metal.
   4. Steel.
   5. Exterior Gypsum Board.
   6. Wood.
   7. Plastic Trim Fabrications.
   8. Exterior Portland Cement plaster (Stucco).
   9. Exterior Insulation Finish Systems (EIFS).
   10. Fiber Cement Siding.
   11. Fiber Cement Trim.

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. Concrete , Cementitious Siding and Plaster Substrates, Non-traffic Surfaces:
1. Latex System:
a. Prime Coat: Primer sealer, latex, exterior, MPI #3: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry.
b. Prime Coat: Latex, exterior, matching topcoat.
c. Intermediate Coat: Latex, exterior, matching topcoat.
d. Topcoat: Latex, exterior, flat, (Gloss Level 1), MPI #10: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
e. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
f. Topcoat: Latex, exterior, satin, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
g. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
h. Topcoat: Latex, exterior, gloss, (Gloss Level 6), MPI #119: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

B. Concrete Substrates, Traffic Surfaces: (MPI EXT 3.2C)
1. Pigmented Polyurethane over Epoxy Slip-Resistant Deck Coating System:
a. Prime Coat: Epoxy gloss, Gloss Level 6, MPI #212: Sherwin-Williams Armorseal 1000 HS. B67W2001 Series, at 2.5 to 4.0 mils dry, per coat.
b. Intermediate: Polyurethane, gloss matching Topcoat.
c. Topcoat: Polyurethane, two-component, pigmented, gloss, Gloss Level 6, MPI #212: Sherwin - Williams Armorseal HS Polyurethane, B65W220 Series, at 2.0 to 3.0 mils dry per coat, with manufacturer's slip resistant aggregate to produce a non-slip finish.

C. CMU Substrates:
   1. Pigmented Polyurethane over High-Build Epoxy System: (MPI EXT 4.2G)
      a. Block Filler: Block filler, epoxy, MPI #116: Sherwin-Williams Kern Cati-Coat HS Epoxy Filler / Sealer, at 10 to 20 mils dry, per coat.
      b. Intermediate Coat: Epoxy, high build, low gloss, MPI #108: Sherwin Williams 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: Sherwin Williams Acrolon 218 HS Acrylic Polyurethane, B65-650 Series, at 3.0 to 6.0 mils dry, per coat.
   2. Latex System: (MPI EXT 4.2L)
      a. Block Filler: Block filler, latex, interior/exterior: S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal (1.8 to 3.1 sq. m per l).
      b. Intermediate Coat: Latex, exterior, matching topcoat.
      c. Topcoat: Latex, exterior, flat, (Gloss Level 1), MPI #10: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
      d. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
      e. Topcoat: Latex, exterior, satin, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
      f. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
      g. Topcoat: Latex, exterior, gloss, (Gloss Level 6), MPI #119: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

D. Steel Substrates:
   1. Pigmented Polyurethane System: (MPI EXT 5.1H)
      a. Prime Coat: Alkyd anti-corrosive, quick dry for metal, MPI #79: Sherwin-Williams KemBond Hi-Solids Alkyd Metal Primer, B50WZ0003 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, B65W00611 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, B65W00611 Series, at 3.0 to 6.0 mils dry, per coat.

E. Galvanized-Metal Substrates:
   1. Alkyd System:
      a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Sherwin-Williams, Protective & Marine, Steel Spec Fast Dry Alkyd, B55 Series, gloss (Gloss Level 5), MPI #96.
   2. 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, eggshell, (Gloss Level 3), MPI #161: S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.

2) 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.
3) Topcoat: Light industrial coating, exterior, water based, gloss, (Gloss Level 6), MPI #164: S-W Pro Industrial Acrylic Gloss Coating, B66-600 Series, at 2.5 to 4.0 mils dry, per coat.

F. Wood Substrates: Including wood ceilings and trim , window sash and trim.
1. Latex System:
a. Prime Coat: Primer, latex for exterior wood, MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat, (Gloss Level 1), MPI #10: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.
d. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
e. Topcoat: Latex, exterior, satin, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
f. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
g. Topcoat: Latex, exterior, gloss, (Gloss Level 6), MPI #119: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.
h. Topcoat: Latex, exterior semi-gloss (Gloss Level 5), MPI #11.
2. Solid Color Stain System:
a. First Coat: Solid color stain, latex, matching topcoat.
b. Topcoat: Solid color stain, latex, slip-resistant, flat, interior/exterior: S-W DeckScapes Exterior Acrylic Solid Color Deck, A15-Series, (Gloss Level 1), MPI #33, at 200 to 400 sq. ft. per gal (4.9 to 9.8 sq. m per l).
3. Semi-Transparent Stain System: (MPI EXT 6.2P)
a. First Coat: Semi-Transparent color stain, waterborne, matching topcoat.
b. Topcoat: Semi-transparent color stain, waterborne, flat, exterior: S-W Superdeck® 2650,A15 Series, Semi-Transparent Waterborne Stain, (Gloss Level 1), MPI #33, at 150 to 250 sq. ft. per gal (4.9 to 9.8 sq. m per l).

G. Wood Substrates, Pedestrian Traffic Surfaces:
1. Latex Floor Paint System:
a. First Coat: Floor paint, latex, slip-resistant, matching topcoat.
b. Topcoat: Floor paint, latex, slip-resistant, low gloss, (maximum Gloss Level 3), MPI #60: S-W ArmorSeal Tread-Plex, B90 Series, at 1.5 to 2.0 mils dry per coat.

H. Plastic Trim Fabrication Substrates: (MPI EXT 6.8A)
1. Latex System: (AZEK)
a. Prime Coat: Primer, bonding, water based, MPI #17.Specially formulated for sun exposure on PVC materials.
b. Intermediate Coat: Latex, exterior, Sherwin Williams VinylSafe (LRV 54 or lower), matching topcoat.
c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15 Sherwin Williams VinylSafe (LRV of 54 or lower).

I. Exterior Gypsum Board Soffits or Portland Cement Plaster Substrates: (MPI EXT 9.1A)
1. Latex System:
a. Prime Coat: Primer sealer, latex, exterior, MPI #3: S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils wet, 3.2 mils dry. (E3).
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, flat, (Gloss Level 1), MPI #10: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

d. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
e. Topcoat: Latex, exterior, satin, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
f. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
g. Topcoat: Latex, exterior, gloss, (Gloss Level 6), MPI #119: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

2. Latex Aggregate/Latex System: (MPI EXT 3.1B)
   a. Prime Coat: Block Filler, Latex, Interior/Exterior, MPI #4: S-W Loxon Block Surfacer, A24W200, at 50 to 100 sq. ft. / gal.(E3)
   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Topcoat: Latex, exterior flat, (Gloss Level 1), MPI #42, fine texture: S-W UltraCrete Textured Masonry Topcoat, A44-800 Series, at 50 to 80 sq. ft. / gal. (E2)

J. Exterior Insulation Finish Systems (EIFS):
1. Latex System: (MPI EXT 9.1A)
   a. First Coat: Latex, exterior, matching topcoat.
   b. Intermediate Coat: Latex, exterior, matching topcoat.
   c. Topcoat: Latex, exterior, flat, (Gloss Level 1), MPI #10: S-W A-100 Exterior Latex Flat, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.(E3)
   d. Topcoat: Latex, exterior, low-sheen, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
   e. Topcoat: Latex, exterior, satin, (Gloss Level 3-4), MPI #15: S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
   f. Topcoat: Latex, exterior, semi-gloss, (Gloss Level 5), MPI #11: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.
   g. Topcoat: Latex, exterior, gloss, (Gloss Level 6), MPI #119: S-W A-100 Exterior Latex Gloss, A8 Series, at 4.0 mils wet, 1.3 mils dry, per coat.

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 interior substrates.
   1. Concrete Masonry Units.
   2. Galvanized metal.
   3. Gypsum board.

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 REFERENCES

A. GreenSeal GS-11 - Standard for Paints, Coatings, Stains, and Sealers; 2021.

B. SSPC-PA 1 - Shop, Field, and Maintenance Coating of Metals; 2016.

C. SSPC-SP 11 - Power-Tool Cleaning to Bare Metal; 2020.

D. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

E. SSPC-SP 2 - Hand Tool Cleaning; 2018.

F. SSPC-SP 3 - Power Tool Cleaning; 2018.

G. SSPC-SP 7 - Brush-Off Blast Cleaning; 2007.

H. GreenSeal GS-11GreenSeal GS-11; Latest Version.

I. US Green Building Council, (USGBC) - Green Seal standards for LEED paint credits. USGBC LEED v4.1-BD+C

J. Occupational Safety and Health Act (OSHA) - Safety Standards.

K. American National Standards Institute (ANSI) - Performance Standards.

L. Paint Decorating Contractors of America (PDCA) - Application Standard.

M. National Paint and Coatings Association (NPCA) - Gloss Standard.

N. American Society for Testing Materials (ASTM) - Testing Methods.

O. Master Paint Institute (MPI #) - Established paint categories and standards.

P. Ozone Transmission Commission (OTC) - Established levels of Volatile Organic Compounds. OTC II.

Q. SCAQMD 1168 - South Coast Air Quality Management District Rule #1168 with latest amendments.

R. SSPC V1 (PM1) - Steel Structures Painting Manual, Vol. 1, Good Painting Practice; Society for Protective Coatings.

S. SSPC V2 (PM2) - Steel Structures Painting Manual, Vol. 2, Systems and Specifications; Society for Protective Coatings.

T. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.
   1. Manufacturer's name, product name and/or catalog number, and general product category.
   2. Cross-reference to specified paint system(s) that the product is to be used in; include description of each system.

B. Submit 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. VOC content.

C. Samples: Submit three paper samples, 5 inches by 7 inches (127mm x 178mm) in size, illustrating selected colors for each color and system selected with specified coats cascaded.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.06 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 “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 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.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

B. Installer Qualifications: All products listed in this section are to be applied by a Painting Contractor with a minimum of five (5) years demonstrated experience in surface preparation and field application of the same type and scope as specified.

C. 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. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
   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.

1.09 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.

C. Disposal:

1. Never pour leftover coating down any sink or drain. Use up material on the job or seal can and store safely for future use.
2. Do not incinerate closed containers.
3. For specific disposal or recycle guidelines, contact the local waste management agency or district. Recycle whenever possible.

1.10 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. If Lead paint is encountered, refer to OSHA "Lead In Construction Standard". Additional regulations may apply if the project is considered EPA defined Target Housing or Child Occupied Facility.

1.11 WARRANTY

A. Inspection of all surfaces to be coated must be done by the manufacturer's representative to insure proper preparation prior to application. All thinners, fillers, primers and finish coatings shall be from the same manufacturer to support a product warranty. Products other than those submitted shall be accompanied by a letter stating its fitness for use and compatibility.

B. At project closeout, provide to the Owner or owner's representative an executed copy of the Manufacturer's standard form outlining the terms and conditions of and any exclusions to their Limited Warranty against Manufacturing Defect.

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. (Basis of Design)
      a. Benjamin Moore & Co. (United States), which is located at: 101 Paragon Dr; Montvale, NJ 07645; Toll Free Tel: 866-708-9181; Email: info@benjaminmoore.com; Web:https://www.benjaminmoore.com|https://www.benjaminmoore.com/en-ca
   2. Sherwin-Williams Company.
   3. PPG Architectural Finishes, Inc.

2.02 PAINT, GENERAL

A. 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.

B. VOC Content: Products shall comply with VOC limits of authorities (OTC II) 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.	Non-Flat Paints and Coatings:	100 g/L.
3.	Non-Flat High Gloss	150 g/L
4.	Dry-Fog Coatings:	150 g/L.
5.	Primers, Sealers, and Undercoaters:	100 g/L.
6.	Quick Dry Enamel	150 g/L.
7.	Anti-corrosive and Antirust Paints Applied to Ferrous Metals:	250 g/L.
8.	Zinc-Rich Industrial Maintenance Primers:	250 g/L.
9.	Industrial Maintenance High Temperature	420 g/L.
10.	Floor Coatings:	100 g/L.
11.	Stains	250 g/L.
12.	Varnish	275 g/L.
13.	Waterproofing Sealer - Wood	275 g/L
14.	Waterproofing Sealer - Concrete	100 g/L.

C. Colors: As selected by Architect from manufacturer's full range.
   1. 30 percent of surface area will be painted with deep tones.

2.03 MIXING AND TINTING

A. Except where specifically noted in this section, all paint shall be ready-mixed and pre-tinted. Agitate all paint prior to and during application to ensure uniform color, gloss, and consistency.

B. Thinner addition shall not exceed manufacturer's printed recommendations. Do not use kerosene or other organic solvents to thin water-based paints.

2.04 WATER-BASED PAINTS

A. Latex, Interior, Flat, (Gloss Level 1): MPI #53.
   1. Benjamin Moore - Ultra Spec 500 Interior Flat Finish T535 (E3)
   2. Sherwin-Williams - Solo - Interior/Exterior 100% Acrylic Flat - A74W00051 (E3)
   3. PPG - Speedhide - Interior Flat Latex - #6-70 (E3).
   4. Architect approved equivalent.

B. Latex, Interior, (Gloss Level 4): MPI #43 (Pearl / Satin / Low Lustre)
   1. Benjamin Moore - Ultra Spec 500 Interior Satin-Pearl Finish T545 (E3).
   2. Sherwin-Williams - ProMar 200 Zero VOC - Interior Latex Semi-Gloss, B31-2600 Series - (E3).
   3. Architect approved equivalent.

C. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143.
   1. Benjamin Moore - Ultra Spec 500 Interior Flat Finish T535 (E3).
   2. Sherwin-Williams - Harmony - Interior Acrylic Latex Flat - B05W01051 (E3)
   3. Architect approved equivalent.

D. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3): MPI #145
   1. Benjamin Moore - Ultra Spec 500 Interior Eggshell Finish T538 (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).
   4. Architect approved equivalent.

E. Latex, Interior, High Performance Architectural, (Gloss Level 2): MPI #138.
   1. Benjamin Moore - Ultra Spec 500 Interior Low Sheen Eggshell Finish T537 (E3)
   2. Sherwin-Williams - SuperPaint - Interior Latex Satin - A87W001151/A87WQ1151 (E3)
   3. Architect approved equivalent.

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 matte 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 BLOCK MASONRY (CMU) (PT-1)
   1. Latex Systems:
      a. Satin Finish: Scuff-Resistant
         1) First Coat: Benjamin Moore Block Filler 0244.
         2) Second Coat: Benjamin Moore, Ultra Spec Scuff-X Interior Satin Finish 486.
         3) Third Coat: Benjamin Moore, Ultra Spec Scuff-X Interior Satin Finish 486.

B. METAL - (Structural Steel Columns, Joists, Trusses, Beams, Miscellaneous and Ornamental Iron, Structural Iron, Ferrous Metal)
   1. Latex Systems:
      a. Satin Finish: Scuff-Resistant
         1) First Coat: Benjamin Moore, Ultra Spec Acrylic Metal Primer HP04.
         2) Second Coat: Benjamin Moore, Ultra Spec Scuff-X Interior Satin Finish 486.
         3) Third Coat: Benjamin Moore, Ultra Spec Scuff-X Interior Satin Finish 486.

C. GYPSUM BOARD - (Walls, Ceilings, Gypsum Board and similar items) (PT-2)
   1. Latex Systems:
      a. Satin Finish: Scuff-Resistant
         1) First Coat: Benjamin Moore Drywall Primer 380.
         2) Second Coat: Benjamin Moore, Ultra Spec Scuff-X Interior Satin Finish 486.
         3) Third Coat: Benjamin Moore, Ultra Spec Scuff-X Interior Satin Finish 486.
   2. Acrylic-Urethane Systems (Water Base): Single-Component, Fast Return to Service

a. Satin Finish:
   1) First Coat: Benjamin Moore Drywall Primer 380.
   2) Second Coat: Benjamin Moore, Corotech COMMAND Waterborne Acrylic Urethane Satin CV392.
   3) Third Coat: Benjamin Moore, Corotech COMMAND Waterborne Acrylic Urethane Satin CV392.

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.

B. SUMMARY
   1. Section includes surface preparation and the application of paint systems on interior substrates.
      a. Concrete.
      b. Concrete Masonry Units.
      c. Steel.
      d. Galvanized metal.
      e. Gypsum board.
      f. Wood.
      g. Aluminum.
      h. Stucco
      i. Clay Masonry

C. DEFINITIONS
   1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.
   2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
   3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
   4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
   5. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.
   6. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.
   7. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

D. ACTION SUBMITTALS
   1. Product Data: For each type of product. Include preparation requirements and application instructions.
      a. Samples for Initial Selection: For each type of topcoat product.
         1) Product List: For each product indicated, include the following:
            (a) Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
            (b) Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
            (c) VOC content.

E. CLOSEOUT SUBMITTALS
   1. 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.

F. MAINTENANCE MATERIAL SUBMITTALS

1. 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.
    a. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

G. QUALITY ASSURANCE
1. 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.
    a. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
        1) Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
            (a) 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.
            (a) Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. DELIVERY, STORAGE, AND HANDLING
1. 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 (7 deg C).
    a. Maintain containers in clean condition, free of foreign materials and residue.
        1) Remove rags and waste from storage areas daily.
2. 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:
    a. Product name and type (description).
        1) Batch date.
        2) Color number.
        3) VOC content.
        4) Environmental handling requirements.
        5) Surface preparation requirements.
        6) Application instructions.

I. FIELD CONDITIONS
1. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F .
    a. 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.
    b. 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. Sherwin-Williams Company.
2. Benjamin Moore & Co.
3. PPG Architectural Finishes, Inc.

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.	Non-Flat Paints and Coatings:	100 g/L.
3.	Non-Flat High Gloss	150 g/L
4.	Dry-Fog Coatings:	150 g/L.
5.	Primers, Sealers, and Undercoaters:	100 g/L.
6.	Quick Dry Enamel	150 g/L.
7.	Anti-corrosive and Antirust Paints Applied to Ferrous Metals:	250 g/L.
8.	Zinc-Rich Industrial Maintenance Primers:	250 g/L.
9.	Industrial Maintenance High Temperature	420 g/L.
10.	Floor Coatings:	100 g/L.
11.	Stains	250 g/L.
12.	Varnish	275 g/L.
13.	Waterproofing Sealer - Wood	275 g/L
14.	Waterproofing Sealer - Concrete	100 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.

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 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. Microbicidal Latex Finish System (Low VOC): With topcoat EPA registered No. 64695-1.
      a. Prime Coat: Primer sealer, latex, interior
         1) S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 mils (0.203 mm) wet, 3.2 mils (0.081 mm) dry.
      b. First Coat: Microbicidal Latex, interior, matching topcoat.
      c. Topcoat: Microbicidal Latex, interior, eggshell:
         1) S-W SuperPaint with Air Purifying Technology, Satin, A87W00061, at 4.0 mils wet, 1.7 mils, per coat. Brush and roll application only.

B. Concrete Substrates, Traffic Surfaces:
   1. 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 #211 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. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.
      a. Block Filler: One or two coats as required:] Block filler, latex, interior/exterior:
         1) S-W Loxon Block Surfacer, A24W200, at 10.0 mils (0.254 mm) wet, 8.0 mils (0.203 mm) dry, per coat.
      b. First Coat: Microbicidal Latex, interior, matching topcoat.
      c. Topcoat: Microbicidal Latex, interior, eggshell:
         1) S-W SuperPaint with Air Purifying Technology, Satin, A87W00061, at 4.0 mils wet, 1.7 mils, per coat. Brush and roll application only.

D. Metal Substrates:

E. Galvanized-Metal Substrates: (PT-4)
   1. Pigmented Polyurethane System: (MPI INT 5.4C)
      a. Prime Coat: Primer, vinyl wash: Sherwin-Williams - DTM Wash Primer, B71Y1, at 0.7 to 1.3 mils dry, per coat.
      b. Intermediate Coat: Polyurethane, two-component, pigmented, matching topcoat.
      c. Topcoat: Hi-Solids Polyurethane 250 Aliphatic Polyurethane,B65J-350 Series, at 3.0 to 5.0 mils dry, per coat

F. (PT-3)Wood Substrates (Microbicidal):
   1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.
      a. Prime Coat: Primer, latex, interior, anti-microbial:

1) S-W PrepRite ProBlock Interior/Exterior Latex Primer/Sealer, at 4.0 mils (0.102 mm) wet, 1.5 mils (0.038 mm) dry.

b. First Coat: Microbicidal Latex, interior, matching topcoat.

c. Topcoat: Microbicidal Latex, interior, eggshell:

1) S-W SuperPaint with Sanitizing Technology, Eg-Shel, A87W0001, at 4.0 mils wet, 1.7 mils, per coat. Brush and roll application only.

2) S-W SuperPaint with Air Purifying Technology, Satin, A87W00061, at 4.0 mils wet, 1.7 mils, per coat. Brush and roll application only.

2. Stain & Varnish

a. Stain: MPI #90: Sherwin Williams - Wood Classics 250 - A49-800 Series (E3)

b. Intermediate Coat: Sherwin Williams - Classics Waterborne Polyurethane Varnish - Satin - 4.0 mils wet, 1.0 mils dry.

c. Topcoat: Sherwin Williams - Classics Waterborne Polyurethane Varnish - Satin - 4.0 mils wet, 1.0 mils dry.

G. Gypsum Board Substrates: (PT-3)

1. Microbicidal Latex Finish System: With topcoat EPA registered No. 64695-1.

a. Prime Coat: Primer, latex, interior:

1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils (0.102 mm) wet, 1.0 mils (0.025 mm) dry.

b. First Coat: Microbicidal Latex, interior, matching topcoat.

c. Topcoat: Microbicidal Latex, interior, eggshell:

1) S-W SuperPaint with Sanitizing Technology, Eg-Shel, A87W0001, at 4.0 mils wet, 1.7 mils, per coat. Brush and roll application only.

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 application of wood finishes on the following substrates:
   1. Interior Substrates:
      a. Dressed lumber (finish carpentry).
      b. Exposed wood panel products.

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 indicated. Include preparation requirements and application instructions.

B. Samples for Initial Selection: For each type of product indicated.

C. Product List: For each product indicated, include the following:
   1. Cross-reference to finish 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 in Part 2, with the product proposed for use highlighted.
   3. VOC content.

1.05 QUALITY ASSURANCE

A. Mockups: Apply mockups of each finish system indicated and each color 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 type of finish system and substrate.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of stain color selections will be based on mockups.
   a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

1.06 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 (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.07 FIELD CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Benjamin Moore & Co.
   2. Sherwin-Williams Company (The).
   3. Pratt & Lambert.

B. Products: Subject to compliance with requirements, provide one of the products listed in other PART 2 articles for the category indicated.

2.02 MATERIALS, 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 finish 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 finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior stains and finishes 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. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
   2. Shellacs, Clear: VOC not more than 730 g/L.
   3. Stains: VOC not more than 250 g/L.

D. Stain Colors: As selected by Architect from manufacturer's full range.

2.03 WOOD FILLERS

A. Wood Filler Paste: MPI #91.

2.04 PRIMERS AND SEALERS

A. Sanding Sealer: MPI #102

2.05 STAINS

A. Stain, Semi-Transparent, for Interior Wood: MPI #186.

2.06 POLYURETHANE VARNISHES

A. Varnish, Interior, Polyurethane, Oil-Modified, Satin (Gloss Level 4): MPI #57.

2.07 SOURCE QUALITY CONTROL

A. Testing of Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample wood finishing materials. Contractor will be notified in advance and may be present when samples are taken. If 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 wood finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces before refinishing with complying materials if the two finishes are incompatible or produce results that, in the opinion of the Architect, are aesthetically unacceptable.

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.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: 13 percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.
   1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
   1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
   2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:
   1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
   2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glass like finish.
   3. Sand surfaces that will be exposed to view and dust off.
   4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.03 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
   1. Use applicators and techniques suited for finish and substrate indicated.
   2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
   3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.04 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.05 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Wood substrates, non-traffic surfaces, including wood-based panel products.
   1. Polyurethane Varnish over Stain System:
      a. Stain Coat: Stain, semi-transparent, for interior wood, MPI #90.
      b. First Intermediate Coat: Polyurethane varnish matching topcoat.
      c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
      d. Topcoat: Varnish, interior, polyurethane, oil-modified, satin (Gloss Level 4), MPI #57.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

B. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

D. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.04 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit color charts for selection of color and texture of markerboard, tackboard, tackboard surface covering, and trim.

E. Test Reports: Show conformance to specified surface burning characteristics requirements.

F. Manufacturer's printed installation instructions.

G. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Regulatory Requirements: Conform to applicable code for flame/smoke rating in tackboards in accordance with ASTM E84.

C. Operation and Maintenance: Include data on regular cleaning, stain removal, and precautions.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

C. Submit a "Life of the Building" warranty, stating that under normal usage and maintenance, and when installed in accordance with manufacturer's instructions and recommendations, Claridge LCS³ porcelain enamel steel markerboard writing surfaces are guaranteed for the life of the building. Guarantee covers replacement of defective boards but does not include cost of removal or reinstallation.

D. Writing Surface Warranty Period: Lifetime years commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
      a. Claridge Products and Equipment, Inc.; Contact: P. O. Box 910, Harrison, AR 72602; Telephone: (870) 743-2200; Fax: (870) 743-1908; E-Mail: claridge@claridgeproducts.com
   2. Substitutions: 012500 - PRODUCT SUBSTITUTION PROCEDURES and Section 016100 - BASIC PRODUCT REQUIREMENTS.

2.02 VISUAL DISPLAY BOARDS

A. Glass magnetic Markerboards: 1/4" tempered low-iron glass with steel back. Claridge Glass magnetic Markerboard Surface: 1/4" tempered low-iron glass with steel back. Magnetic surface with Invisi-Mount.
   1. Color: As selected from manufacturer's full range.
   2. Size: As indicated on drawings.
   3. Frame: No frame, with concealed fasteners.
   4. Accessories: Provide Accessory Tray.

2.03 MATERIALS

A. Steel Sheet Backing: 28 gage, 0.0149 inch (0.38 mm), galvanized.

B. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.

B. Mounting Brackets: Concealed.

2.05 FABRICATION

A. Assembly: Factory Assembled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify before installation that interior moisture and temperature approximate normal occupied conditions.

D. Verify that wall surfaces are prepared and ready to receive boards.

E. Verify flat wall surface for frameless adhesive-applied boards.

3.02 INSTALLATION

A. Deliver factory built units completely assembled and of dimensions shown in details and in accordance with manufacturer’s shop drawings as approved by the architect.

B. Follow manufacturer’s instructions for storage and handling of units before installation.

C. Install boards in accordance with manufacturer's instructions.

D. Do not install boards on damp walls or in damp and humid weather without heat in the building.

E. Install level and plumb, keeping perimeter trim straight in accordance with manufacturer’s recommendations.

F. Secure units level and plumb.

G. Carefully cut holes in boards for thermostats and wall switches.

3.03 ADJUST AND CLEAN

A. Verify that all accessories are installed as required for each unit.

B. Clean board surfaces in accordance with manufacturer's instructions.

C. Cover with protective cover, taped to frame.

D. Remove temporary protective cover at 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 plaques.

1.03 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.
   1. Include fabrication and installation details and attachments to other work.
   2. Show plaque mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each plaque at least half size for review and approval prior to fabrication.

C. Samples for Verification: For each type of plaque showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Plaques: Full-size corner sample showing at a minimum frame corner, plaque panel thickness material, texture and raised lettering in type face selected..
   2. Exposed Accessories: Full-size Sample of each accessory type.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.06 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
   2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.02 PLAQUES

A. Cast Plaque: Plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
   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. Precision Signs.
      b. Gemini Incorporated.
      c. Metallic Arts.
      d. Nelson-Harkins Industries.
      e. Southwell Company (The).
      f. US Bronze Sign Co.
   2. Plaque Material: Cast bronze.
   3. Plaque Thickness: 0.50 inch (12.7 mm).
   4. Finishes:
      a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
      b. Overcoat: Clear organic coating.
   5. Background Texture: As selected by Architect from manufacturer's full range.
   6. Integrally Cast Border Style: Projected bevel.
   7. Mounting: Concealed studs.
   8. Text and Typeface: typeface as selected by Architect from manufacturer's full range.
   9. Plaque Size: 24 inch x 36 inch minimum or as indicated on the drawings.
   10. Graphics and Logos: As indicated on the drawings.

2.03 MATERIALS

A. Bronze Castings: ASTM B 584, lead-free alloy recommended by manufacturer and finisher for finish indicated.

2.04 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
   3. Plaque Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque, unless otherwise indicated.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.05 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.
   1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.

4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.
1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

2.06 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.07 CLEAR ORGANIC COATING FOR COPPER-ALLOY FINISHES

A. Clear Organic Coating: Clear, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of methyl methacrylate copolymer with benzotriazole to prevent breakdown of the film in UV light; shop applied in two uniform coats per manufacturer's written instructions, with interim drying between coats and without runs or other surface imperfections, to a total dry film thickness of 1 mil (0.025 mm).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of plaque work.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
   2. Shim-Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach plaques to plate using method specified above.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by 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. Room and door identification signs.
   2. Roof Truss Identification Signage.

1.03 RELATED REQUIREMENTS:

A. Section 015000 - GLAZING for temporary Project identification signs and for temporary information and directional signs.

1.04 DEFINITIONS

A. Accessible: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and 1 for signs.

1.05 ACTION SUBMITTALS

A. See Section 013300 - SUBMITTALS.

B. Product Data: For each type of product. Include Manufacturer’s construction details relative to materials, dimensions of individual components, profiles, and finishes for each type of sign required.

C. Shop Drawings: For panel signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.
   2. Provide manufacturer's full color palette in the form of a color deck or actual samples for selections by the Architect.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Sample Warranty: For special warranty.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

C. Single Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

D. Handle products in accordance with Manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Field Measurements: Verify locations of signage and field mounting surfaces in the field before fabrication, and indicate measurements on Shop Drawings.

B. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

C. Maintain this minimum temperature during and after installation of signs.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within manufacturers specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PANEL SIGNS, GENERAL

A. Regional Materials: Panel signs shall be manufactured within 500 miles (800 km) of Project site.

2.02 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.03 INTERIOR SIGNAGE

A. Manufacturer: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
   1. ASI Sign Systems, Inc.
      a. ASI, 8181 Jetstar Drive, Suite 100, Irving, Texas 75063; (214) 352- 9140; telephone; (214) 352-9741 facsimile; (800) ASI-SPEC [274-7732]
   2. Best Sign Systems Inc.
   3. Mohawk Sign Systems.
   4. Precision Signs.

B. Room Identification and Panel Signage: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

C. Interior Signage: Sign with smooth, uniform Photopolymer matte (non-glare) surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles on an Acrylic backing plate material as follows:
   1. Basis-of-Design Product: ASI Sign Systems, Inc.; InTouch ADA-Ready Sign System.
   2. Acrylic Sheet Sign: face sheet with raised graphics laminated to backing sheet to produce composite sheet.
      a. Material Thickness: 0.125 inch thick matte finish acrylic.
      b. Text and Graphics: Tactile copy and Grade 2 Braille raised 1/32 inch minimum from sign surface by manufacturer's photopolymer bonded integrally on a single material. Precisely formed lettering and graphics, uniformly opaque, ADA compliant in size, style, spacing, content, position and colors.
      c. Sign Sizes: As indicated on the drawings.
      d. Sign Shape: As indicated on the drawings.
      e. Sign Graphics: As indicated on the drawings.
      f. Letter Style: As selected by the Architect from the manufacturer's full text style offering.
      g. Letter Size: As selected by the Architect from the manufacturer's full text style size offering or as indicated on the drawings.
      h. Color(s): As selected by the Architect from the manufacturer's full color offering.
      i. Mounting: System CSMH-Counter Sunk mechanical fasteners.

2.04 ROOF TRUSS IDENTIFICATION SIGNAGE:

A. Substrate: 0.040 inch aluminum with 1/8 inch mounting holes or flexible vinyl label stock with permanent adhesive.

B. Reflective sign graphic image.

C. UV, Chemical, abrasion and moisture resistant.

D. Compliant with ICC Building Code Requirements

E. Locations: Signs shall be located at each exterior building entrance. Sign mounting height and placement shall be as indicated on the drawings in conformance to ICC Building Code Requirements

2.05 SIGN MATERIALS

A. Acrylic Covers / Properties:
   1. Excellent weather resistance.
   2. Long stability against UV degradation.

B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.06 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
   3. Exposed Metal-Fastener Components, General:
      a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
      b. Fastener Heads: For nonstructural connections, use screws and bolts with tamper-resistant spanner-head slots unless otherwise indicated.
   4. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
   5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.07 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   4. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
   5. Form panels to required size and shape. Comply with requirements indicated for design, dimensions finish, color, and details of construction.
   6. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

B. Surface Graphics: Raised graphics to be applied to sign face by Manufacturer’s standard processes. Face of raised graphics to be raised 1/32 inch min. from plaque first surface.

Precisely formed, uniformly opaque graphics to comply with current ADAAG guidelines and the requirements indicated for size, style, spacing, content, position and colors.

C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

2.08 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that mounting locations for each sign exist which comply with ICC A117.1, Chapter 7.

C. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

D. Verify that anchor inserts are correctly sized and located to accommodate signs.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Install signs so they do not protrude or obstruct according to the accessibility standard.
   3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Room Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to ICC A117.1 accessibility standards.

C. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
   a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
   b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
5. Mount signs in accordance with the manufactures specifications using non-corrosive vandal-resistant fasteners finished to match adjacent sign material.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast Metal Building Signage - Interior and Exterior.

B. Corporate logos and graphics

1.02 RELATED REQUIREMENTS

A. Section 013300 - SUBMITTALS: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 014500 - QUALITY CONTROL: Procedures for testing, inspection, mock-ups, reports, certificates; use of reference standards.

C. Section 017800 - HOLLOW METAL DOORS AND FRAMES: Project record documents, operation and maintenance (O&M) data, warranties and bonds.

1.03 PRICE AND PAYMENT PROCEDURES

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Meeting will be held with the Owner to determine final mounting locations and heights of the various cast metal letters, numerals, signs, and Maltese Cross units.

1.06 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Submit product data for specified products. Include material details for each sign specified.

C. Shop Drawings: Submit shop drawings showing layout, locations on the building, scaled elevations, profiles, and product components, including dimensions, anchorage, and accessories.

D. Samples: Submit approved manufacturer color chart for selection purposes and selected colors for verification purposes.

E. Installation: Submit approved manufacturers handling, storage and installation instructions. Provide mounting / anchor wall overlay for accurate fastening pattern.

F. Closeout Submittals:
   1. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.
   2. Submit warranty documents specified herein.

G. Erection Drawings: Provide anchoring location template.

H. Manufacturer's Qualification Statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Supplier: Obtain all products in this section from a single supplier.

B. Regulatory Requirements: Products shall meet requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and local amendments and modifications.

C. Installer: Installation shall be performed by installer specialized and experienced in work similar to that required for this project acceptable to the manufacturer as evidenced in writing.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

E. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store products protected from weather, temperature, and other harmful conditions as recommended by supplier.

D. Handle products in accordance with manufacturer's instructions.

1.09 WARRANTY

A. See Section 017800 - HOLLOW METAL DOORS AND FRAMES, for additional warranty requirements.

B. Manufacturer's Warranty: Submit manufacturer's standard warranty document executed by authorized company official.

C. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SIGNAGE SYSTEMS

A. Basis of Design Manufacturer: ASI.
   1. ASI, 3860 W. Northwest Highway, Suite 350, Dallas, TX 75220; (214) 352- 9140 telephone; (214) 352-9741 facsimile; (800) ASI-SPEC [274-7732].
   2. Precision Signs.com.
   3. Or approved equal.

B. Product: Series LC Cast Metal Dimensional Letters.
   1. Material:
      a. Cast Aluminum in Satin Anodized finish or as selected by the Architect.
   2. Fabricated Letter and Numbers:
      a. Letterstyle: Arial or style indicated on the drawings.
      b. Letter Cap Height: 12 inches or heights as indicated on the drawings.
      c. Letter Depth: 1 inch minimum or depths as indicated on the drawings.
   3. Fabricated Maltese Cross Castings:
      a. Sizes and configuration: as indicated on the drawings.
      b. Thickness: 1 inch minimum with multiple height surfaces to achieve relief shown on the drawings up to 2 1/2 inch depth.
   4. Mounting Method:
      a. Projected Mount at interior locations. Provide 1/2 inch clearance from arris of masonry or as indicated on the drawings.
      b. Projected Mount at exterior locations

2.02 GENERAL

A. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

B. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stressing of welds and fasteners.

C. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

D. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

E. Create signage to required sizes and layout. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

2.03 ACCESSORIES

A. Fasteners: Provide non-corrosive studs, spacers, nuts and other devices required for the installation in materials that are compatible with the sign materials. Signage manufacturer shall approve all mounting materials prior to use..

B. Adhesive: Silicone as recommended for the installation as recommended by the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions: Verify installation conditions previously established under other sections are acceptable for product installation in accordance with manufacturer's instructions.

B. Scheduling of installation by Owner or it’s representative implies that substrate and conditions are prepared and ready for product installation. Proceeding with installation implies installer’s acceptance of substrate and conditions.

3.02 INSTALLATION

A. Install product in accordance with manufacturers instructions.

B. Install product in locations indicated using mounting methods recommended by sign manufacturer and as approved on the shop drawings, free from distortion, warp, or defect adversely affecting appearance.

C. Install product level, plumb, and at heights indicated.

D. Install product at heights to conform to Americans with Disabilities Act Accessibility Guidelines (ADAAG) and applicable local amendments and regulations, as applicable.

E. Install signs within the following tolerances and in accordance with manufacturer's recommendations:
   1. Interior Signs: Within 1/4 inch vertically and horizontally of intended location.

F. Exterior Signs: Within 1/2 inch vertically and horizontally of intended location

3.03 FIELD QUALITY CONTROL

A. See Section 014500 - QUALITY CONTROL, for additional requirements.

B. Provide manufacturer's field representative to inspect signage materials and installations.

3.04 CLEANING

A. Repair scratches and other damage which might have occurred during installation. Replace damaged components.

B. Remove temporary coverings and protection to adjacent work areas. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove construction debris from project in accordance with provisions in Division 1.

3.05 PROTECTION

A. Protect installed Cast Building Signage from subsequent construction operations.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Signs.

B. Posts.

1.02 REFERENCES

A. ASTM A36 - Structural Steel.

B. MUTCD - Manual of Uniform Traffic Control Devices.

C. NYSDOT (New York State Department of Transportation) Standard Specifications.

1.03 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Shop Drawings: Indicate mounting and construction details.

C. Certificates: Provide certificate from supplier indicating products meet or exceed specified requirements.

1.04 REGULATORY REQUIREMENTS

A. All materials and installation are to be in accordance with the Federal MUTCD and Section 645 of the NYSDOT Standard Specifications.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle products in a manner which will not damage the reflective face of the sign or dent the sign in any way.

1.06 COORDINATION

A. Coordinate placement of post with the placement of adjacent restoration materials, ground cover or pavements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Signs: Aluminum alloy 6061-T6, 0.100 inch thick; galvanized.

B. Posts: ASTM A36 galvanized steel U-channel; 2 lbs./linear foot.

2.02 ACCESSORIES

A. Hardware: 2-inch bolt with nut and lockwasher; Galvanized aluminum.

2.03 FABRICATION

A. Fabricate posts with mounting holes as required to install sign.

B. Fabricate all signs to the sizes and shapes as indicated by the NYSDOT MUTCD.

C. Holes in the sign may be drilled or punched; all cut edges must be smooth, true and free from burrs and ragged breaks.

2.04 FINISHES

A. Signs: Flexible, weather resistant and reflectorized finish; of the colors indicated by the NYSDOT MUTCD.

B. Posts: Green enamel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing site and conditions.

B. Verify that signs will be visible from roadway in their proposed locations.

3.02 INSTALLATION

A. Excavate as required to install post to the depth required.

B. Place post such that the post is installed truly vertical.

C. Signs shall be installed with the following alignment:
   1. Handicap Parking Signs: Face of sign parallel to the smaller parking space dimension.
   2. All Other Signs: Face of sign to be 87 degrees from the centerline of the roadway or travelway.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 2 degrees.

B. Maximum Variation from True Alignment: 1 degree.

3.04 CLEANING

A. Clean all sign faces to provide proper reflectivity.

3.05 PROTECTION

A. Protect finished work under provisions of Section 015000.

B. Protect signs and posts from damage until project is accepted by the Owner.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Touchscreen Meeting Room Screen System.

1.02 REFERENCE STANDARDS

A. ANSI/Infocomm 10 - Audiovisual Systems Performance Verification; 2013.

B. UL 879 - Electric Sign Components; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting two weeks prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 35 - 35, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets on panelized LED display systems including recommendations for preparation, storage and handling, and installation.

C. Shop Drawings: Indicate cable routing, connections between equipment, anchor and support details, and adjacent construction.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Project Record Documents: Provide quantities, type, and location for components, cabling and accessories.

F. System Setting Backup: Provide an electronic file of all system settings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Authorized Manufacturer Representative: System shall be configured and commissioned by an authorized manufacturer representative.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in compliance with manufacturer instructions.

1.07 WARRANTY

A. See Section 52 - 52, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. VisioSign: Blackline-10POE-LUX-ENG, Product Number 303076 with touch.

2.02 PANELIZED LED VIDEO DISPLAY

A. Performance Requirements:
   1. Comply with performance standards based on tests conducted in accordance with ANSI/Infocomm 10.
   2. Provide products that are listed and labeled as complying with UL 879, where applicable.

B. System Type: Flat.
   1. Material: Black steel cabinet, shock-resistant aluminum frame, glass front.
   2. Pixel Pitch: 10.1", 1280 x 800, PCAP touch, 16:10
   3. Horizontal Viewing Angle: 170 degrees (plus/minus 85 degrees off center).
   4. Vertical Viewing Angle: 160 degrees (plus/minus 80 degrees off center).
   5. Brightness: 350 NIT, under typical conditions adjustable
   6. Mount Type: Custom Wall Mount. Integral to each unit. Mount shall conceal connection ports located on the back of each unit. Each screen shall have a hidden reset button.
   7. Mounting: Portrait or Landscape.
   8. Location: Indoor.
   9. Total Height: 6.65 in (169 mm).
   10. Total Width: 9.84 in (250 mm).
   11. Panel Depth: 1.30 inches (33 mm).
   12. Power consumption: 15 Watts max., Fanless, SSD
   13. Power: Power over Ethernet IEEE 802.3 af / a.
   14. Software: Windows 10.
      a. Ability to interface and directly extract and view meeting information from booking-systems such as Outlook and Google Calendar.

2.03 CONTROLS

A. Interface Unit:
   1. Fully programmable Dual LED functionality for ambient lighting or room occupancy status indication.
   2. Touch-activated content can be combined with standardized information.
   3. Information can be fully integrated with the VisioSign Cloud. Content can be differentiated at each screen to integrate general and local specific.
   4. With the following abilities; scale media, rotate media, adjust brightness, loop output, and input selection.
   5. Input source supports DVI, HDMI, PC, VGA, and S-Video.
   6. Output to Cat6. Network cable can be connected form any of the four sides.
   7. Working Voltage: 120 VAC / 240 VAC at 60Hz.

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 and urinal screens.
   2. Partition Style:
      a. Floor Anchored / Overhead Braced.

1.03 REFERENCES

A. ASTM A351/A351M - Standard Specification for Castings, Austenitic, for Pressure-Containing Parts; 2018, with Editorial Revision (2019).

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings; 2018, with Editorial Revision.

D. ICC A117.1-2009 - Accessible and Usable Buildings and Facilities; 2009.

E. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2019.

F. 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. Material Fire Ratings:
   1. National Fire Protection Association - NFPA 286: Pass.

D. 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 ICC A117.1 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. Fire-resistance Rating: NFPA 286.
   3. Aluminum Extrusions: ASTM B221, 6463-T5 alloy and temper.
   4. Stainless Steel Castings: ASTM A351/A351M, Type 304.
   5. Edges: Radius.

2.02 SOLID-POLYMER UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASI Global (Basis of Design)
   2. Scranton Products.
   3. Accurate Partitions

B. Toilet Enclosure Style: Floor Anchored/Overhead Braced.

C. Entrance-Screen Style: Floor Anchored/Overhead Braced.

D. Urinal-Screen Style: Wall Hung. Urinal Screen size(s) shall be as indicated on the drawings.

E. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE)or panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges,, 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.

F. Pilaster Shoes and Sleeves (Caps):
   1. Three Inch high manufacturer's standard design; 18 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.

G. Urinal-Screen Post: Manufacturer's standard 1 3/4inch heavy-duty aluminum post with chrome-plated escutcheons and caps.

H. Brackets (Fittings):
   1. Full-Height (Continuous) U-Type
      a. Extruded heavy-duty aluminum 6463-T5 alloy as indicated on the drawings.
      b. 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.

I. Door Hardware:
   1. Continuous stainless steel helix.
   2. Continuous stainless steel spring hinge.
   3. 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.
   4. 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. 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.
      c. Provide occupancy indicator.
   5. 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.
   6. Each door shall be supplied with one coat hook/bumper and door pull made of chrome plated Zamac.
   7. Equip outswing handicapped doors with second door pull and door stop.
   8. Emergency access required by lifting door upwards and allowing latch to disengage.

2.03 SOLID PLASTIC SHOWER AND DRESSING COMPARTMENTS

A. Provide plastic privacy screens in shower room applications as indicated or scheduled.

B. Panels and pilasters shall be 1 inch (25 mm) thick with all edges rounded to a radius. Screens shall be mounted at 14 inches (356 mm) above the finished floor. Colors shall be as selected by Architect from manufacturer's full line of current colors.
   1. Recycled content: Minimum 25 percent.

C. Type: Floor mounted pilaster supported screen.
   1. Panels: Panel screens shall be 76 inches (1930 mm) high.
   2. Pilaster: Pilaster screens shall be 82 inches (2083 mm) high.
   3. Headrail: Headrail shall be made of heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design and integrated curtain track. The headrail shall have a clear anodized finish and 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.
   4. 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.
   5. Pilaster sleeves shall be 3 inches (76 mm) high. Pilaster sleeves shall be stainless steel (type 304, 18 gauge) secured to the pilaster with a stainless steel tamper resistant Torx head sex bolt.
   6. Wall brackets shall be continuous U brackets made of heavy-duty aluminum (6463-T5 alloy) with a bright dip anodized satin finish. Brackets shall be fastened to panel/pilaster with stainless steel tamper resistant Torx head sex bolts.
   7. Shower Curtains: White, non PVC, 42 inches wide x 72 inches high, hung with aluminum curtain hooks with self-lubricating Delrin slides.

2.04 SOLID PLASTIC VANITY

A. Provide vanities in sizes and applications as indicated or scheduled.

B. Tops, Splashes, Skirts, End and Center Supports: 1 inch (25 mm) thick with all edges rounded to a radius. Screens shall be mounted at 14 inches (356 mm) above the finished floor. Colors as selected by Architect from manufacturer's full line of current colors.

C. Three Inch high manufacturer's standard design; 18 gauge, Type 304 stainless steel secured to pilaster with stainless steel tamper-resistant Torx head sex bolt.

D. Attachment Brackets: 16 inches (406 mm) long, heavy duty extruded aluminum with bright dip anodized finish.

2.05 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Stainless Steel.
   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 heavy-duty extruded aluminum 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.

2.06 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. 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. 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 SECTION INCLUDES

A. Unitized-panel demountable partitions.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

D. ASTM E72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

G. ASTM E413 - Classification for Rating Sound Insulation; 2022.

H. BIFMA X5.6 - Panel Systems - Tests; 2016 (Reapproved 2021).

1.04 DEFINITION

A. The movable wall system shall offer maximum flexibility and reusability to accommodate frequent and quick relocation work without loss of materials, damage or modification to panels or to adjoining structures such as ceilings, fixed walls and floors. The system must be unitized, non-progressive and modular, allowing the removal of individual panels from any location without disturbing adjoining units and providing interchangeability of panels and door units on the same module.

B. The system can offer a single center reveal design with optional concealed slotting for wall-hung furniture components utilizing a pliable recessed panel connector, a shallow panel connector between panels provides a single center reveal design which matches the finish of the panel face, or a flush connector finished to match the panel to provide a monolithic aesthetic. The head detail is either recessed or flush. The base assembly with an integrated leveling system shall be permanently attached to the panel. Detached and loosely shipped floor tracks and leveling components shall not be permitted.

C. The solid panels shall be available in a choice of finishes to include marker board steel, wood veneer. Panels are stackable to accommodate ceiling height changes and panel type changes (i.e., solid/glass). Panel shells shall be removable and interchangeable in the field without dismantling as complete units.

1.05 PERFORMANCE REQUIREMENTS

A. Adjustability: An adjustable, u-channel head assembly shall provide a ± 1/2" adjustment at the ceiling. At the floor, a self-contained leveling glide system and a flush 5"-high base cover shall allow for an adjustment of ± 1 ½” for a 5” base. Combined, this shall provide an overall vertical adjustment of ± 2” for 5” to compensate for ceiling and floor irregularities.
   1. Where the wall system meets the building core walls, columns or window mullions, a telescopic, spring-loaded wall post or u-channel shall allow for a ±1" horizontal adjustment.

B. Electrical & Communications: Typically, power/communications cables and components shall be provided and field-installed (hardwired) by the electrical contractor. Wiring access shall be through or around the ceiling channel, and distribution shall run vertically or horizontally anywhere within the panel, from panel to panel or through the base and ceiling wire ways. Electrical outlets shall be located flush in the base or in the panel shell.

C. 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: 25 or less.
   2. Smoke-Developed Index: 450 or less.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

E. Structural Performance: Provide demountable partitions capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Load-Bearing Capacity: Not less than 2.3-lb/linear inch distributed proof load when tested according to BIFMA X5.6.
   2. Transverse-Load Capacity: Lateral deflection of not more than 1/240 of the overall span when tested under a uniformly distributed load of 5 lb/sq. ft. according to ASTM E72.

F. Acoustical Performance: Where acoustical rating is indicated, provide demountable-partition assembly tested by a qualified testing agency for sound transmission loss performance according to ASTM E90, calculated according to ASTM E413, and rated for not less than the STC value indicated.

1.06 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Product data on physical characteristics, durability, resistance to fading, and flame spread characteristics for each type of partition and accessory.
   1. "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Indicate plans, elevations, sections, attachment details at floors, columns, permanent construction and ceilings, and method of erection and disassembly.

D. Samples: Submit two samples 6 inches square in size illustrating wall covering facing and trim colors and finish.

E. Samples for Initial Selection: For each type of exposed finish.
   1. Include Samples of hardware and accessories involving color or finish selection.

F. Samples for Verification: For each type of the following products:
   1. Face-Panel Finish: Manufacturer's standard-size unit, but not less than 6 inches square.
   2. Linear Trim: 12-inch- long Samples.
   3. Door Finish: Manufacturer's standard-size unit, but not less than 3 inches square.
   4. Glazing: Manufacturer's standard-size unit, but not less than 3 inches square.
   5. Hardware and Accessories: Whole units.

1.07 INFORMATIONAL SUBMITTALS

A. 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 the installers of the items involved.
   1. Suspended-ceiling components and dimensioned ceiling-grid layout.
   2. Locations of fixed door and window mullions.
   3. Seismic bracing and related structural members.
   4. Ductwork above ceiling.

B. Product Certificates: For each type of demountable partition.

C. Product Test Reports: For each type of demountable-partition assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Manufacturer's Instructions: Indicate special procedures.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.09 CLOSEOUT SUBMITTALS

A. Maintenance Data: For demountable partitions to include in maintenance manuals.

1.10 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.11 FIELD CONDITIONS

A. Finished Spaces: Do not deliver or install demountable partitions until finishes in spaces to receive them are complete, including suspended ceilings, floors, carpeting, and painting.

B. Field Measurements: Indicate measurements on Shop Drawings.

1.12 WARRANTY

A. Demountable wall panels, glazed units, door frames, and related components to be without defects in material or workmanship for a period of ten (10) years from the date of acceptance of

work. Wood veneer wrapped parts shall be warranted to be without defects in material or workmanship for a period of five (5) years from the date of delivery. Wood doors shall be warranted for ten (10) years from the date of delivery, subject to the manufacturer's terms and conditions. This warranty does not cover defects or damage resulting from accidents, misuse, improper relocation methods or transfer to storage. Vinyl and textile wall coverings, plastic laminates, and wood veneer finishes are not warranted against fading or wearing, or if improperly cleaned or treated by the Owner or by others.

PART 2 PRODUCTS

2.01 UNITIZED-PANEL DEMOUNTABLE PARTITIONS (DPP-1)

A. General: Unitized, nonprogressive, demountable-partition assembly and components that are the standard products of the manufacturer.
   1. Manufacturer: Demountable-partition shall be as "LightLine Architectural Wall" manufactured by KI of Green Bay Wisconsin, Tel. (920)468-8100.
   2. Architect approved equivalent.

B. Acoustical Rating: STC 48 for solid panels.

C. Solid Panels With Project Specific Substrate: 3-1/2 inch thick consisting of an aluminum extruded frame construction, two removable panel shell assemblies each composed of Wood Veneer face laminated to MDF, non-toxic fiberglass insulation, and base assembly. Top of panel engages the ceiling channel. Aluminum frames (including glass panels) as a standard will have cavities on each side to accommodate cabling. Field notching the horizontal frame members to allow easy cable access from ceiling or floor. As standard, solid panel vertical frame posts can be slotted for hang-on furniture and the slots concealed by a dual durometer PVC gasket, 1" wide recessed from panel face or by a flush to panel face 1" wide recessed from panel face or by a flush to panel face connector. Panels to contain integral, adjustable bottom connectors, and the panel shells equipped with a mushroom-shaped extrusion that forms a compression fit with the vertical frame for easy removal from the frame structure.

D. Unitized Panels: Manufacturer's standard two removable panel shell assemblies each composed of Wood Veneer face laminated to MDF, non-toxic fiberglass insulation, and base assembly.
   1. Thickness: 2 1/8 inches.
   2. Panel Widths: Modular, as indicated on Drawings, except for required filler panels.
   3. Facing: Wood veneer.
      a. Color, Texture, and Pattern: As selected by the Architect from the manufacturer's full color, texture and pattern offerings..

E. Accessory Panels: Manufacturer's standard porcelain-enamel markerboard.

F. Framing: Aluminum.
   1. Exposed Finish: As selected by the Architect from the manufacturer's full color offering., AAMA 611, Class II, 0.010 mm or thicker clear anodic coating over a nonspecular as fabricated mechanical finish.

G. Trim: Continuous, factory-finished, snap-on type; adjustable for variations in floor and ceiling levels.
   1. Trim Material: aluminum.
   2. Base Profile: Flush.
   3. Ceiling Trim Profile: Recessed.
   4. Exposed-Metal Trim Finish: As selected by the Architect from the manufacturer's full color offering., AAMA 611, Class II, 0.010 mm or thicker clear anodic coating over a nonspecular as fabricated mechanical finish.

H. Doors: Manufacturer's standard 1-3/4-inch thick, Aluminum Framed Glass Swing Door with 2 1/8 inch Stiles door construction.
   1. Door Type: Single Swing.
   2. Aluminum Door Finish: As selected by the Architect from the manufacturer's full color offering.

I. Hardware: As specified in Section 087100 - DOOR HARDWARE or as specified herein.

J. Glazing Frames: Manufacturer's standard aluminum frames for glazing thickness indicated.
   1. Frame Finish: Clear-anodized aluminum.

K. Glazing:
   1. Thickness: 1/2 inch (12mm) standard tempered laminated glass

L. Seals: Manufacturer's standard.

2.02 FABRICATION

A. General: Fabricate demountable walls for installation with concealed fastening devices and pressure-fit members that will not damage ceiling or floor coverings. Fabricate systems for installation with continuous seals at floor, ceiling, and other locations where partitions abut fixed construction.

B. Panels for Site-Assembled Demountable Partitions: Face panels fabricated and finished in modular widths indicated.
   1. Transom Panels: Fabricated in material and finish to match wall panels unless otherwise indicated.

C. Panels for Unitized-Panel Demountable Partitions: Factory-assembled, flush, unitized-panel construction; with faces smooth and free of buckles, oil canning, and seams; and insulated with solidly packed, inorganic, mineral filler.
   1. Factory glaze panels to the greatest extent possible.

D. Finish Facings: Factory apply finish-facing materials with appropriate backings, using mildew-resistant nonstaining adhesive as recommended by finish-material manufacturer's written instructions.
   1. Apply facing to panel in one piece, seamless.

2.03 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.04 MATERIALS

A. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Glazing:
   1. Tempered Glass: Annealed flat glass meeting requirements of ASTM C1036, Type 1-Transparent Flat, Class 1-Clear, Quality Q3, and fully tempered in accordance with ASTM C1048, Kind FT.

a. Thickness: 3/8 inch (9.5 mm).
b. Prepare glazing panels for indicated fittings and hardware before tempering.
c. Temper glass materials horizontally; visible tong marks or tong mark distortions are not permitted.

C. Wood Materials:
1. Wood Veneer: Genuine wood veneer; clear, vertical grain, straight, and kiln dried; of wood species indicated, laminated to panel substrate with moisture-resistant adhesive.

2.05 FITTINGS AND HARDWARE

A. Non-Locking Ladder Pulls: Tubular pull handles.
1. Mounting: As indicated on drawings.
2. Diameter: 1-3/8 inch (35 mm).
3. Length: 28-3/8 inch (720 mm).
4. Pull Material: Stainless steel.
5. Finish: Satin.
6. Door Thickness: 1-3/4 inch (44.5 mm).
7. Door Material: Wood.
8. Provide accessories as required for complete installation.

B. Overhead Sliding Door Track and Cover extrusions with the following components:
1. PVC Frame connections.
2. Nylon Block on bottom adjustment bracket.
3. Door Bumper on Door Stop in track on non-strike side.
4. Trolleys.
5. Glazing gaskets at doors with glazing.
6. Door operating force: Less than 3.5 ponds of force to operate.
7. Clear Anodized Concealed Track Assembly.
a. Height: 1.41 inches (35.8mm)
b. Track Depth:.925 inches (23.5mm).
c. Track width: 152 inches (3860.8mm) Double Door Track. Two tracks joined at middle.
d. Provide unique hanger design fastened to the Movable Wall frame system or drywall.
e. Provide seismic brackets installed to support tracks at middle of joint.
f. Provide hidden links frame alignments and gap controls.
g. Provide Powder-coated recessed ceiling channel with free-float adjustment from top of wall to ceiling, sealed with a gasket.
h. Provide panel connectors at frame connections between door frame and adjacent framing.

C. Door Seal components:
1. Weather stripping on guide side.
2. Flex door bumper co-extrusion on strike post.
3. Tongue and Groove seal for wood double sliding doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building conditions are ready to receive partitions and that field measured dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install partitions after placement of carpet. Install demountable partitions after other finishing operations have been completed.
   1. Install partitions rigid, level, plumb, and aligned. Install seals at connections with floors, ceilings, fixed walls, and abutting surfaces to prevent light and sound transmission.
   2. Broken, cracked, chipped, deformed, or unmatched panels and components are not acceptable.
   3. Except for filler panels scribed to fixed walls or columns, do not modify manufacturer's standard components.

B. Suspended-Ceiling System: Do not alter suspended-ceiling system.

C. Doors and Frames: Install door-and-frame and glazing-and-glazing-frame assemblies securely anchored to partitions and with doors aligned and fitted. Install and adjust door hardware for proper operation.

3.03 TOLERANCES

A. Install each demountable partition so surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent partitions.

3.04 ADJUSTING

A. Adjust doors and frames to provide smooth door operation from open to closed position without gravity movement of door from any position.

B. Check and readjust operating hardware. Verify that latches and locks engage accurately and securely without forcing or binding; lubricate as recommended by manufacturer.

C. Inspect installation, correct misalignments, and tighten loose connections.

D. Clean soiled surfaces to remove dirt, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

E. Remove and replace defaced or damaged components that cannot be satisfactorily repaired.

F. Remove and replace components that are wet, moisture damaged, or mold damaged.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain demountable partitions.

3.06 PROTECTION

A. Do not permit subsequent construction activities to cause damage to appearance or operation of installed partition components before 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. Impact-resistant wall coverings.

1.03 ACTION SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

C. Product Data: Indicate physical dimensions and features.

D. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent Include sections, details, and attachments to other work.

E. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.
   1. Include similar Samples of accent strips and accessories involving color selection.

F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Impact-Resistant Wall Covering: 6 by 6 inches square.

1.04 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each impact-resistant plastic material including fire rating certifications, from manufacturer.

B. Material Test Reports: For each impact-resistant plastic material.

C. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

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. Impact resistant wall coverings: Provide full width roll material in a quantity equal to at least 2 percent of each type, texture and color of materials installed. Replacement materials shall be from same production run as installed units.

B. Include mounting and accessory covers, closures and end cap components. Replacement materials shall be from same production run as installed units.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014500 - QUALITY CONTROL.

D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E84, NFPA 255, or UL 723 by UL or another qualified testing agency.

E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.
   3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
      a. Store corner-guard covers in a vertical position.
      b. Store wall guards covers in a horizontal position.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of plastic and other materials beyond normal use.
   2. Warranty Period: Five years from date of Substantial Completion. Provide manufacturer's Limited Lifetime Warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.01 MATERIALS

2.02 IMPACT-RESISTANT WALL COVERINGS (WP-1)

A. Flexible Wall Covering: (WP-1)
   1. Ricochet™ Flexible Wall Protection as manufactured by IPC Door and Wall Protection Systems; Division of InPro Corporation or Architect approved equivalent.
      a. Finished width: 48 inches
      b. Inks: HAPS free, Ethyl Acetate.
      c. Low VOC emitting:
      d. Packaging – 15 yard rolls
   2. Physical Properties:
      a. Finished total weight: Fed. Spec. CCC-T-191b 5041.
         1) Thickness:.032” - .040” (varies by emboss and finish).
         2) 34 to 38 oz. per linear yard (555g to 620 g/linear m), varies by emboss and finish.
      b. PVF protective cap film.
      c. Backing Type: Poly/Cotton knit. (77%/23%)
   3. Surface Properties.
      a. Impact Resistance, ASTM D-5420: – 44 to 112+ inch-lbs.
      b. Abrasion Resistance, ASTM D4060: 0.02% weight loss.
      c. Chemical Resistance, ASTM D1308: No change.
      d. Stain Resistance, ASTM D1308: No change
      e. Streptoverticillium Reticulum Stain Resistance – ASTM E1428: No visible stain.
   4. Fire Ratings
      a. Surface burning, ASTM E84: Class A.
         1) Flame Spread Index: 10
         2) Smoke Developed: 120
   5. Environment and Health
      a. CAL 01350 Certified
      b. Fungal Resistance, ASTM G21: No growth
      c. Bacterial Resistance, ASTM G-22: No growth
      d. EPD 3rd Party Certified.
      e. HPD 3rd Party Certified.
      f. NSF/ANSI 342 Certified (WCA Sustainability Std.)
   6. Design
      a. Pattern: As selected by the Architect from the manufacturer's full pattern offering.
      b. Color: As selected by the Architect from the manufacturer's full color offering.
   7. Accessories:
      a. Vinyl PVC Top Trim: Extruded rigid plastic that matches sheet wall covering color.
      b. Adhesive: Roman Pro-555 Extreme Tack Wallcovering Adhesive.
         1) Contains mold inhibitor.
         2) Compatible with wall coverings.
         3) Use undiluted.
      c. Extruded Aluminum Corner Trim: Fry Reglet, Model WCTOSC.

2.03 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.04 METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Remove tool and die marks and stretch lines, or blend into finish.
   2. Grind and polish surfaces to produce uniform finish, free of cross scratches.
   3. Run grain of directional finishes with long dimension of each piece.
   4. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
   1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

C. Acclimate materials to building conditions for at least 24 hours prior to installation.

3.03 INSTALLATION

A. Install items specified in the section in strict accordance with the manufacturer’s instructions.

B. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings or, if not indicated, at heights indicated below:

a. Impact- Resistant Wall Coverings: 48 inches above finish floor or as indicated on the drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
   a. Provide anchoring devices to withstand imposed loads.
   b. Where splices occur in horizontal runs of more than 20 feet (6.1 m), splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches (305 mm).
   c. Adjust end and top caps as required to ensure tight seams.

C. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation.

3.04 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent unless directed otherwise by the manufacturer.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

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. Childcare accessories.
   5. Underlavatory guards.
   6. Custodial accessories.

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, 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. Surface Mounted Paper Towel Disposal / Dispenser (AC-07):
   1. Basis-of-Design Product: Kimberley-Clark, Scott Pro Recessed Hard Roll Towel Disposal Model No 35370 / 31501 Dispenser.
      a. Description: Recess-mounted paper towel disposal unit fabricated to accept Scott Pro Dispenser 31501 unit. Unit receptacle has a 9.22 gallon capacity leak-proof molded trash container ,behind a hinged stainless door with key-activated lock. Cabinet shall be 18-8, type 304 heavy 22 gauge stainless steel, all welded construction with satin finish. Overall unit size: 56 inches high, 17.13 inches wide, with a door projection of 5.45 inches deep and 14.83 inches wide. Recess portion is 3.80 inches deep and 10.34 inches wide. Required recess: 11.5 inches wide, 4 inches deep and 54.5 inches high.
      b. Mounting: Provide concealed backing to comply with local building codes. Secure with sheet metal screws expansion anchors or toggle bolts as required for the wall construction. Mount at height required to meet ADA/Accessible design requirements.
      c. Door shall be mounted with full-length stainless steel piano hinge.
      d. Lockset: Semi-concealed tumbler type. Keyed alike to all other locking toilet accessories.
      e. Dispenser: Kimberley-Clark Professional, Recessed MOD Touchless Hard roll Towel Dispenser, Model 31501. housing is 22 gauge brushed stainless steel utilizes one 8 inch diameter roll of 1150 feet of product plus stub roll utilizing core plug mounting.

f. Unit Size: 13.97 inches wide x 16.10 inches high x 4.88 projection from wall and 4.01 inches of recess into wall.

C. Liquid-Soap Dispensers (AC-05):
1. Basis-of-Design Product: Bradley 6A01-11 - Diplomat Series.
a. Description: Designed for dispensing soap in foam soap / foam sanitizer. Sensor-operated unit with low battery ((4) AA alkaline batteries) indicator light (Red when low). Corrosion-resistant foam soap/sanitizer valve.
b. Mounting: Vertically oriented; surface-mounted.
c. Capacity: 27 Fluid oz.
d. Overall Size: 4 5/8 inches Wide x 10 9/16 inches high x 4 3/16 inches deep.
e. Materials: Hinged Cover with face formed with rounded contours, radii and finish, Type 304 Stainless steel, Heavy gauge, No. 4 finish (satin), welded construction. Completely concealed ABS plastic wall mounting plate.
f. Lockset: Tumbler type. Keyed alike to all other Toilet Accessories.
g. Refill Indicator: Vandal-resistant filler hole cover / sight gauge.

D. Grab Bars (AC-09):
1. Basis-of-Design Product: Bobrick Model B-6806-Series.
a. Mounting: Flanges with concealed vandal resistant fasteners.
b. Material: 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. Concealed mounting flanges shall be 1/8 inch thick stainless steel plate, 2 inches x 3-1/8 inches, and equipped with two screw holes for attachment to wall. Flange covers shall be 22 gauge, 3-1/4 inches diameter x 1/2 inch deep, and shall snap over mounting flange to conceal mounting screws and/or wingtip fasteners. 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 117.1.) for structural strength and configurations.

E. Napkin / Tampon Vendor: (AC-12)
1. Basis-of-Design Product: Bobrick Model No. B-47069 C (No-Coin (Free) 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: C (No-Coin (Free) 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.

F. Sanitary-Napkin Disposal Units (AC-10):
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).

G. Toilet Seat Cover Dispenser: (AC-11)
1. Basis-of-Design Product: Bobrick Model B-4221 - Contura Series.
2. Mounting: Surface mounted. Mount as indicated on the drawings.
3. Size: 15 3/4 inches wide x 11 1/4 inches high x 2 3/16 inches deep.
4. Capacity: 250 single or half-fold paper toilet seat covers
5. Exposed Material and Finish: 18-8. Type 304, Stainless steel, 20 Ga. No. 4 finish (satin). Drawn, one-piece seamless construction with arc plan profile and radius corners and edges.

H. Mirror Units (AC-04):
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 30 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.

I. Tilt Mirror Units (AC-03):
1. Basis-of-Design Product: Bobrick Model B-293 1830.
a. Frame: 18-8, 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.
2) Frame Taper: 4 3/8 inches depth at top to 1 5/16 inches depth at bottom.
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 30 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, 1/8 inch (3mm) 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. Robe Hooks (AC-02):
   1. Basis of Design Product: Bobrick B-2116 or approved equal.
   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 lb downward force capacity.
   5. Unit projects 3 7/16 inches (Bobrick) from wall.
   6. Flange diameter: 2 3/4 inches.

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-06):
   1. Basis-of-Design Product: Excel Dryer - XLERATOR XL-SB 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 3/8 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.

2.05 CHILDCARE ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Koala Kare Products; a division of Bobrick Washroom Equipment, Inc.
   2. Architect approved equivalent.

B. Diaper-Changing Stations AC-13:
   1. Basis-of-Design Product: Bobrick KB310-SSRE (Recess Mounted) or approved equal. Constructed with 56% recycled materials (LEED).
   2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
      a. Engineered to support a minimum of 250-lb static load when opened.
      b. Maximum child weight capacity: less than 50 pounds.
   3. Unit Dimensions: 41-5/16 inches wide x 26-7/32 inches high.
   4. Rough wall opening: 35 1/2 inches wide x 20 1/2 inches high.37-1/16 inches wide x 21-5/8 inches high.
   5. Mounting: Recessed mounting requiring clear wall depth of 4 1/4 inches, with unit projecting not more than 1/4 inch from wall when closed.
   6. Operation: By pneumatic shock-absorbing mechanism.
   7. Material and Finish: Stainless steel, No. 4 finish (satin), with replaceable insulated polystyrene tray liner and rounded plastic corners.
   8. Liner Dispenser: Built in.

2.06 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Truebro by IPS Corporation.
   2. Or approved equal.

B. Underlavatory Guards:
   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.

2.07 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 AC-14:
   1. Basis-of-Design Product: Bobrick Model B-239 x 34.
      a. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
      b. Length: 34 inches (864 mm).
      c. Hooks: Four.

d. Mop / Broom Holders: Three, spring-loaded, rubber hat, cam type.
e. Material and Finish: Stainless steel, No. 4 finish (satin).
f. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.

2.08 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 Owner's representative.

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 F 446.

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

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-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.

C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

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.

2.02 FIRE-PROTECTION CABINETS

A. Cabinet Type: Suitable for fire extinguishers.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Activar Construction Products Group, Inc. - JL Industries, Inc. (Basis of Design)
      b. Larsen's Manufacturing Company.
      c. Potter Roemer LLC.

B. Cabinet Construction: Nonrated and rated, see drawings for locations of wall rated assembelies.

C. Cabinet Series: ORBIT LOW PROFILE

D. Recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Trim Type: Flat 3/8 inch.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Powder-coated Steel.
   1. Color and Finish: White Powder-Coat paint.

G. Tub Material: Cold rolled steel (standard) with white powder-coat finish (Standard)

H. Door Style: Vertical Duo panel with pull handle.

I. Door Glazing: Clear Tempered Glass.
   1. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear obscure).

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 recessed 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. Locate as specified.
      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: Black.
         4) Orientation: Vertical.

2.03 FIRE PROTECTION CABINETS (OVAL TYPE EXTINGUISHERS)

A. Recessed Low Profile Tub Cabinet for Oval Fire Extinguishers: Orbit Series cabinets to fit into a 3 5/8 inch stud wall and meet ADA 4 inch maximum requirement for protruding objects. Manufacturer: Activar Construction Products Group, Inc. - JL Industries or approved equal.
   1. Flush door with 5/8 inch door stop.
   2. 3/8 inch flat trim with 1 3/4 inch face on frame and 1 1/4 inch trim on door.
   3. Continuous hinge.
   4. Zinc plated handle and roller catch.
   5. Clear Acrylic Glazing.
   6. Finish: Powder-coated Steel
   7. Fire-Rated: Provide FX2 option.

2.04 FIRE COMPANY KEY ACCESS UNIT

A. KNOX-BOX 3200 Series: Recessed Mount - Model 3275 with recess mounting kit (RMK) with hinged door 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: Alarm Tamper Switch (UL Listed), Recessed Mounting Kit (RMK), and Inside switch for electrical doors, gates and other electrical equipment.
   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: Aluminum.
   8. Location: As indicated by Fire Marshal.

2.05 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Provide factory-drilled mounting holes.
   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.

2.06 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. Proceed with installation only after unsatisfactory conditions have been corrected.

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: 48 inches above finished floor to top of fire extinguisher handle (ADA).

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
   2. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb, to comply with manufacturer's instructions.

C. Identification: Apply vinyl lettering at locations indicated.

D. Wall Signs:
   1. Location: Where shown or directed.
   2. Apply on walls after field painting is completed and has been accepted.

E. 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. 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. JL Industries, Inc.; a division of the Activar Construction Products Group.
      b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
      c. Potter Roemer LLC.
      d. 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.

C. In Kitchen locations provide Class K type Fire extinguishers as required by the authority having jurisdiction.
   1. Purple-K Dry-Chemical Type in Aluminum Container : UL-rated 30-B:C, 5-lb (2.3-kg) nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

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. JL Industries, Inc.; a division of the Activar Construction Products Group
      b. Larsen's Manufacturing Company.
      c. 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

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

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pre-formed thermoplastic panel for enclosing roof top mechanical equipment.
   2. Aluminum assembly framing for direct attachment of screening panels to mechanical equipment.
   3. Sliding panels to permit easy access to mechanical equipment for servicing.

B. Related Sections:
   1. Substitutions: Section 012500 - WOOD I-JOISTS.

1.02 REFERENCES

A. ASTM B221 - Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire Profiles, and Tubes.

B. AA ADM-1516166 - Aluminum Design Manual

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

1.03 SYSTEM DESCRIPTION

A. Design Criteria:
   1. Materials, assembly and structural design shall resist snow, wind, suction and uplift loading at any point without damage or permanent set.
   2. Framing shall be designed in accordance with the Aluminum Design Manual to resist the following loading:
      a. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's catalog data, detail sheets, specification and other data sufficient to indicate compliance with these specifications.

B. Shop Drawings: Indicate layouts heights, component connection details, and details of interface with adjacent construction. Mark data to indicate:
   1. Roof top mechanical equipment to be enclosed.

C. Samples:
   1. Samples of Materials: thermoplastic.
   2. Color Selection: Submit paint chart with full range of colors available for selection by the Architect.

D. Certification: Manufacturer's Certificate of Compliance certifying that thermoplastic panels supplied meet or exceed specified requirements.

E. Closeout Submittals: Warranty documents, issued and executed by manufacturer, countersigned by Contractor.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of building authorities having jurisdiction in Project location.

B. Manufacturer Qualifications: Minimum five (5) years documented experience producing systems specified in this section.

C. Pre-Installation Meeting:
   1. Convene at job site seven (7) calendar days prior to scheduled beginning of construction activities of this section to review requirements of this section.
   2. Required attendees: Representatives of the installing contractor/manufacturer's field representative, Mechanical Contractor, Owner's Construction Representative and the General Contractors representative and other entities directly affected by construction activities of this section.
   3. Notify Architect four (4) calendar days in advance of scheduled meeting date.

1.06 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.

1.07 PROJECT CONDITIONS

A. Field Measurements: Contractor shall take measurements of actual roof top unit(s) for fit without gaps. Indicate measurements on shop drawings fully documenting any field condition that may interfere with the screen system fabrication/installation.

1.08 COORDINATION

A. Installer shall be responsible for verification of field conditions and coordination of panel and framing sizes along with required options specified.
   1. All this information shall be included on the Shop Drawings.

B. Submit shop drawings to the Contractor for verification, after verification/approval by the Contractor, then submit shop drawings to the Architect and obtain written approval from the Architect of the shop drawings prior to commencement of fabrication.

1.09 WARRANTY

A. Rooftop equipment screen shall be warranted against any and all manufacturing defects for the period of one year from the date of substantial completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Products: Envisor Screening System by CityScapes Incorporated, 4200 Lyman Ct. Hilliard, OH 43026. 1-877-727-3367 www.cityscapesinc.com or approved equal.

B. Substitutions: Submit in accordance with Section 012500 - WOOD I-JOISTS.

2.02 MATERIALS

A. Panel Type:
   1. Perforated Metal Panels: Fabricated from rigid aluminum panels in multiple thicknesses.
      a. Minimum thickness: 0.063 inch

B. Framing: Aluminum Plate, Shapes and Bar: ASTM B221, alloy 6061-T5 or 6063-T5.

C. Threaded Fasteners: All screws, bolts, nut and washers shall be Stainless Steel.
   1. Corner assembly fasteners shall be #10-16 x stainless steel TEK screws. Length as required to develop full holding capacity of screw.
   2. Provide lock washer or other locking device at all bolted connections.

2.03 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. Panel Design, Style, Trim:
   1. Panel Style: Vertical.
   2. Panel Design:
      a. AcryliCap: Horizontal Rib.
      b. Metal Series: 7.2 Rib
   3. Decorative Top Trim Profile: Step 2

D. Trim and Closures: Fabricated from 24 gage metal, and finished with the manufacturers standard coating system, unless shown otherwise on drawings.

E. Framing: Fabricate and assemble components in largest practical sizes, for delivery to the site.
   1. Construct corner assemblies to required shape with joints tightly fitted.
   2. Supply components required for anchorage of framing. Fabricate anchors and related components of material and finish as required, or as specifically noted.

F. FINISHES
   1. Aluminum Framing: Aluminum Color: As selected by the Architect form the manufacturer's full color offering..
   2. Factory-applied Panel Coating:
      a. Color: As selected by the Architect form the manufacturer's full color offering.

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 INSTALLATION

A. Install units in accordance with the manufacturer's instructions and approved shop drawings. Keep perimeter lines straight, plumb, and level. Provide brackets, anchors, and accessories required for a complete installation.

B. Fasten structural supports to HVAC units without damaging or inhibiting unit operation or maintenance access to the unit.

1. Provide corner and mid-span assemblies as required by approved shop drawings so that the panels are supported uniformly and in accordance with design loading requirements.
2. Fastening bottom rail using removable bolts to permit ease of access to HVAC units.

C. Insert thermoplastic panels into structural supports, except where fixed attachment points are indicated. Butt thermoplastic 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, to eliminate dissimilar metals contact.

E. Do not cut or abrade factory finishes requiring modification. Contractor shall return items requiring modification to the factory for modification(s) and re-finishing at no additional cost to the contract.

3.03 ERECTION TOLERANCES

A. Maximum misalignment from true position in any direction: ¼ inch.

3.04 CLEANING AND PROTECTION

A. Remove and legally dispose of all protective masking material from the installed units immediately after installation.

B. Protection:
1. Ensure that finishes and structure of installed Equipment Screens are not damaged by subsequent construction activities.
2. If minor damage to finishes occurs, repair damage in accordance with manufacturer's recommendations; provide matching replacement components should any repairs are deemed unacceptable by the Architect, Owner or Owner's Construction Representative.

C. Prior to Substantial Completion: Remove dust or other foreign matter from component surfaces; clean finishes in accordance with manufacturer's instructions.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping: Plumbing connections for appliances.

B. Section 260583 - Wiring Connections: Electrical connections for appliances.

1.03 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013300 - SHEET METAL WORK, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

C. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

D. Provide ten (10) year manufacturer warranty on tub and door liner of dishwashers.

E. Provide one (1) year manufacturer Labor and Parts warranty on the entire washing machine appliances.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Refrigerator, E03: Free-standing, side-by-side, Refrigerator and frost-free.
   1. Capacity: Total minimum storage of 25.3 cubic feet; 16.07 Refrigerator.

2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE). Energy Star Compliant.
3. Refrigerator Features: Include LED lighting, Automatic icemaker, Water filter indicator, and Multi-Level Drawers (2), Adjustable Glass Shelves (3), Spill-Out Shelves (1), Adjustable Bins (2), Fixed Bins (2), Dairy Compartment.
4. Freezer Features: Fixed Shelves (2), Adjustable Shelves (2), Wire Basket (1) Wire Shelves (3), and Sweet Spot Shelf.
5. Exterior Finish: Stainless steel.
6. Size: 69 5/8 inches high, 36 inches wide and 34 3/4 inches deep including door.
7. Model Number: GSS25GYPFS - Fingerprint Resistant.
8. Electrical Requirements: 15 Amp Circuit.
9. Refrigerant Type: R600a
10. Manufacturers:
    a. GE Appliances; ____: www.geappliances.com.
    b. Architect approved equivalent.
    c. Substitutions: See Section 016100 - Product Requirements
11. Warranty: 1 Year Parts and Labor.

C. Range, Type E01, 5.3 Cubic Foot : Electric, free-standing, glass-ceramic cooktop with Rear Controls.
1. Dimensions: 29 7/8 inches (733.425 mm) wide, 28 inches (711.2 mm) deep with 47 inches (1193.8 mm) height.
2. Oven: Self-cleaning with electronic ignition.
3. Ceramic Elements: Four (4). Left Front Element - 3100W, 6 inch / 9 inch; Left Rear Element - 1200W, 6 inch size; Right Front Element - 3100W, 6 inch / 9 inch size; Right Rear Element - 1200W, 6 inch size.
4. Controls: Digital Temperature Display, Electronic, and Touchpads
5. Control types: Bake, Broil, Delay Start, Delay Bake, Self Clean (Steam), Delay Clean, Kitchen Timer, Timed Cook, Auto Oven Shut-off, and Oven Lock-out
6. Features: Include storage drawer, oven door window, oven light, 2 Standard Racks, Even Baking Technology, Vari-Broil (Hi/Lo), Bake Element / Broil Element, and Rear Filler Trim.
7. Metal Reach Through Handle.
8. Exterior Finish: Stainless steel with Black Glass Cooktop Surface.
9. Model Number: JB645RKSS
10. Manufacturers:
    a. GE Appliances: www.geappliances.com.
    b. Substitutions: See Section 016100 - Product Requirements and 012500 - WOOD I-JOISTS.
11. Warranty: 1 Year Parts and Labor.

D. Dishwasher, E02: Undercounter.
1. Controls: Top controls with 8 touchpads.
2. Energy Star Qualified.
3. Wash Cycles: Cycles (5). China Crystal, Energy Saver, Heavy, Normal, Quick, Rinse Only, and Upper Rack
4. Option Selections: High Temperature, Start/Cancel, and 1-12 hour Delay
5. Features: Include rinse aid dispenser, optional water temperature boost, adjustable upper rack, Last Cycle Memory, Silverware Baskets (3), and Cup Shelf.
6. Finish: Stainless steel.
7. Tub Material: Stainless Steel.
8. Rack Material: Nylon coated Deluxe.
9. Silverware Baskets: Lower Rack (3).
10. Water Supply: Supplied hose to suit 3/8 inch male compression fitting.
11. Water Filtration System: Removable Filter.
12. Certifications and Approvals: Energy Star and ADA compliant

13. Dimensions: 34 inches high, 24 inches deep, 23 3/4 inches wide.
14. Model Number: GDP670SYVFS - Fingerprint Resistant Stainless Steel.
15. Electrical: 120V; 60Hz; 6.6A.
16. Manufacturers:
    a. GE Appliances; ____: www.geappliances.com.
    b. Architect approved equivalent.
    c. Substitutions: See Section 016100 - Product Requirements and 012500 - WOOD I-JOISTS.
17. Warranty: 1 Year Parts and Labor.

2.02 LAUNDRY APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Clothes Washer (IL units), E04: Front-loading with Precision Dispense.
1. Size: Large capacity. 4.8 cu. ft.
2. ADA Compliant: Height, Side and Front Reach Compliant.
3. Energy Star Qualified.
4. Controls: Rotary-Electronic w/LEDs, Power On/Off, Start/Pause, Capacitive Touch.
5. Cycles: 10 cycles including Normal, Self Clean, Whites, Towels, Bulky/Bedding, Sanitize with Oxi, Quick Wash, Delicates, Cold Wash, and Rinse + Spin.
6. Motor Speed: Variable.
7. Motor Drive Type: Direct Drive
8. Drum Material: Stainless Steel.
9. Temperature Selections: Cold, Cool, Hot, Warm.
10. Control Display Type: Cycle Indicator Lights with Digital Time Remaining.
11. Features: Include optional second rinse, bleach dispenser, fabric softener dispenser, self-cleaning lint filter, sound insulation, end of cycle signal, and four water levels.
12. Finish: Painted steel with porcelain enamel top, color GFP1528SNWW - WHITE.
13. Dimensions: 39 3/4 inches high x 32 inches deep w. x 28 inches wide.
14. Manufacturers:
    a. GE Appliances; GFW550SSN: www.geappliances.com.
    b. Architect approved equivalent.
    c. Substitutions: See Section 016100 - Product Requirements and 012500 - WOOD I-JOISTS.

C. Clothes Dryer (IL Units), E05: Electric, stationary with Quick Dry Cycle
1. Size: Large capacity, 7.8 cu. ft.
2. ADA compliant
3. Controls: Rotary-Electronic w/LEDs, Power On/Off, Start/Pause, Capacitive Touch, with electronic moisture-sensing dry control.
4. Temperature Selections: Five: Air Only, High, Low, Mediumm, Cool.
5. Energy Star Qualified
6. Cycles: 10 cycles including Mixed Loads, Timed Dry, Cottons, Towels, Bulky / Bedding, Sanitize, Quick Dry, Delicates, Perm Press, Dewrinkle.
7. Features: Include Control Lock, Adjustable End-of-Cycle Signal, LED Display Digital Cycle Countdown, LED Indicators, Remote Start, My Settings, Delay Dry - Up to 24 hours.
8. Status Indicators: Check Lint Screen, Check Vent, Cool Down, Done, Estimated Time Remaining, Wet, Wrinkle Shield.
9. Exhaust Options: 4-Way (Rear; Left, Right, Bottom)
10. Drum Material: Powder Coat.
11. Stackable
12. Pedestal: optional
13. Finish: Painted steel with porcelain enamel top, color GFP1528SNWW - WHITE.
14. Dimensions: 28 inches wide, 32 inches deep, 39 3/4 inches high.

15. Manufacturers:
    a. GE Appliances; GFD55ESSN: www.geappliances.com.
    b. Architect approved equivalent.
    c. Substitutions: See Section 016100 - Product Requirements and 012500 - WOOD I-JOISTS.

D. Clothes Washer, E07: Top-loading stationary.
1. Size: Large capacity. 4.5 DOE cu. ft.
2. Controls: Rotary-Electronic LED.
3. Cycles: 14 cycles including Colors/Normal (Deep Clean, Normal, Light), Whites (Heavy, Normal, Light), Delicates, Casuals, Speed Wash, Rinse/Drain & Spin, Active Wear, Bulky Items, Jeans, Towels & Sheets.
4. Motor Speed: Single-speed. 700 RPM Maximum
5. Wash Mechanism: Dual-Action Agitator.
6. Wash/Rinse Temperatures: 6
7. Wash/Spin Speed Combinations: Variable.
8. Wash Basket Type: Stainless Steel.
9. Features: Include Deep Fill, Auto Soak, 2nd Rinse, Extra Spin, 2nd Rinse + Extra Spin, Deep Rinse + 2nd Rinse, and four water levels.
10. Finish: Painted steel, color GTW465ASNWW – White.
11. Size: 42 inches high x 25 1/2 inches deep w. x 27 inches wide.
12. Manufacturers:
    a. GE Appliances; GTW465ASN: www.geappliances.com.
    b. Architect approved equivalent.
    c. Substitutions: See Section 016100 - Product Requirements and 012500 - WOOD I-JOISTS.

E. Clothes Dryer, E06: Electric, stationary.
1. Size: Large capacity. 7.2 cu. ft.
2. Controls: Electromechanical, with timer dry control.
3. Temperature Selections: Three.
4. Timed Dry: 80 minutes, Quick Fluff (no heat)
5. Cycles: 3 cycles including normal, permanent press, and knit/delicate.
6. Features: Include sound insulation and end of cycle signal.
7. Exhaust Options: 4-Way (Rear; Right; Left; Bottom)
8. Drum Type: Aluminized Alloy.
9. Finish: Painted steel, color GTD33EASKWW – White.
10. Manufacturers:
    a. GE Appliances; GTD33EASK : www.geappliances.com.
    b. Architect approved equivalent.
    c. Substitutions: See Section 016100 - Product Requirements and 012500 - WOOD I-JOISTS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions using manufacturer mounting kits and equipment.

B. Anchor built-in equipment in place to facilitate removal for maintenance and future removals as they become necessary.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation, level appearance and even clearances to adjacent construction and building features.

B. Verify that installations comply with ADA regulations where applicable.

3.04 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment in accordance with the manufacturer's recommendations and guidelines.

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. Fabricated equipment.
   2. Cooking equipment.
   3. Self-contained refrigeration equipment.

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment for installation by Contractor.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Manufacturer's model number.
   2. Accessories and components that will be included for Project.
   3. Clearance requirements for access and maintenance.
   4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Samples of special warranty.

1.05 QUALITY ASSURANCE

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Steam Equipment: Provide steam-generating and direct-steam heating equipment that is fabricated and labeled to comply with ASME Boiler and Pressure Vessel Code.

1.06 REGULATORY REQUIREMENTS:

A. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

B. ASHRAE Std 15, "Safety Code for Mechanical Refrigeration."

C. NFPA 54, "National Fuel Gas Code."

D. NFPA 70, "National Electrical Code."

E. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.08 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including layout and installation of lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate locations and requirements of utility service connections.

C. Coordinate sizes, locations, and requirements of the following:
1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Insulated floors.
5. Floor areas with positive slopes to drains.
6. Floor sinks and drains serving foodservice equipment.
7. Roof curbs, equipment supports, and penetrations.

1.09 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.
1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FABRICATED EQUIPMENT

A. Equipment to be supplied by owner and installed by Contractor.

B. Stainless-Steel Kitchen Workable with Sink, and Enclosed Base Cabinets: K-02[]
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
a. Advance Tabco EB-SS-306
b. Or approved equal.
2. Description: One-compartment sink, base cabinet, and counter top combination. Fabricate units of welded stainless steel, sound deadened.
a. Bowls: Stainless steel, Type 304, 16 ga
b. Body: Stainless steel, Type 304, 16 ga.
c. Legs and Feet: Stainless steel tubing legs with adjustable feet.
d. Backsplash: 10 inches tall with 2 inch wide return.
e. Sink: 20"x28"x14" Model TA-11G
f. Faucet Holes: Deck Mounted Swing w/Spray. 4” O.C. Model K-50. Provided, coordinate with plumbing fixtures.
g. Stainless Steel Base Cabinet 30"x36".

C. Stainless-Steel Kitchen Workable with Sink, and Enclosed Base Cabinets: K-03[]
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:

a. Advance Tabco EB-SS-308
b. Or approved equal.

2. Description: One-compartment sink, base cabinet, and counter top combination. Fabricate units of welded stainless steel, sound deadened.
   a. Bowls: Stainless steel, Type 304, 16 ga
   b. Body: Stainless steel, Type 304, 16 ga.
   c. Legs and Feet: Stainless steel tubing legs with adjustable feet.
   d. Backsplash: 10 inches tall with 2 inch wide return.
   e. Sink: 20"x28"x14" Model TA-11G
   f. Faucet Holes: Deck Mounted Swing w/Spray. 4” O.C. Model K-50. Provided, coordinate with plumbing fixtures.
   g. Stainless Steel Base Cabinet 30"x60".

D. Stainless-Steel Kitchen Workable, and Enclosed Base Cabinets: K-04[]
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco HB-SS-303M
      b. Or approved equal.
   2. Description: Base cabinet, and counter top combination. Fabricate units of welded stainless steel, sound deadened.
      a. Body: Stainless steel, Type 304, 16 ga.
      b. Legs and Feet: Stainless steel tubing legs with adjustable feet.
      c. Backsplash: 10 inches tall with 2 inch wide return.
      d. Stainless Steel Base Cabinet 30"x36".

E. Stainless-Steel Kitchen Workable with ADA Sink, and Enclosed Base Cabinets: K-23[]
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco TBD
      b. Or approved equal.
   2. Description: One-compartment ADA sink, base cabinet, and counter top combination. Fabricate units of welded stainless steel, sound deadened.
      a. Bowls: Stainless steel, Type 304, 16 ga
      b. Body: Stainless steel, Type 304, 16 ga.
      c. Legs and Feet: Stainless steel tubing legs with adjustable feet.
      d. Backsplash: 10 inches tall with 2 inch wide return.
      e. Sink: 20"x28"x6" Model TBD
      f. Faucet Holes: Deck Mounted Swing w/Spray. 4” O.C. Model K-50. Provided, coordinate with plumbing fixtures.
      g. Stainless Steel Base Cabinet 30"x36".

F. Splash Mount Prerinse Faucet: K-02, K-03, K-23
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: K-50
      b. Or approved equal.
   2. Description:
      a. Materials: Brass chrome plated body, chrome plated handles
      b. 4" O.C. water supply
      c. Quarter-turn wedge style handles
      d. Spray head with continous water ring
      e. Heavy duty hose spring
      f. Countertop mount bracket
      g. Flow Rate: 1.0 GPM @ 60 PSI

G. Stainless-Steel Hand Sink with Faucet: K-12
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: 7-PS-46

b. Or approved equal.

2. Description:
   a. Bowl: 16” x 14” x 5”.
   b. 6” Extended splash mounted gooseneck faucet with wrist handles & deck mounted liquid soap dispenser.
   c. Front loading paper towel dispenser (Standard C-Fold Towels).
   d. Stainless Steel Skirt with Removable Access Panel and enclosed bottom for storage.
   e. Faucet: Manufacturer provided 6 inch "D" spout faucet furnished with aerator, with hands-free knee pedal operation.

H. Stainless-Steel Three-compartment Sink with Drainboards: K-09
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco : Dishtable Model DTC-3-1620-84L
      b. or approved equal.
   2. Description: Two -compartment sink. Fabricate units of welded stainless steel, sound deadened.
      a. Materials: 14 gauge, type 304 stainless steel.
      b. Bowls: 16” x 20” x 14” Stainless steel, Type 304, 16 ga
      c. Basket Drain: 1-1/2 inch IPS.
      d. Integral Drainboards: 23” Stainless steel, Type 304, 0.078 inch (1.98 mm) thick.
      e. Backsplash: 10-1/2 inches tall with 2 inch wide return.
      f. Legs and Feet: Stainless steel tubing legs with adjustable feet.
      g. Faucet Holes: Provided, coordinate with plumbing fixtures.

I. Stainless-Steel Table:K-13 _____
   1. Products: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: CB-SS-309
      b. or approved equal.
   2. Description: Flat-countertop table.
      a. Tops: Stainless steel, Type 304, 0.078 inch (1.98 mm) thick, reinforced and sound deadened.
         1) Edge: Bullnose on front edgeand splash on back , straight on sides.
      b. Adjustable Undershelf: Stainless steel, Type 304, 0.050 inch (1.27 mm) thick.
      c. Legs: Stainless-steel tubing.
      d. Backsplash: 5" with 1" return on rear side
   3. Materials:
      a. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
   4. Stainless-Steel Finish: Directional satin finish, No. 4.

J. Stainless-Steel Table:K-10 _____
   1. Products: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: CB-SS-2410M
      b. or approved equal.
   2. Description: Flat-countertop table.
      a. Tops: Stainless steel, Type 304, 0.078 inch (1.98 mm) thick, reinforced and sound deadened.
         1) Edge: Bullnose on front edgeand splash on back , straight on sides.
      b. Adjustable Undershelf: Stainless steel, Type 304, 0.050 inch (1.27 mm) thick.
      c. Legs: Stainless-steel tubing.
      d. Backsplash: 5" with 1" return on rear side
   3. Materials:
      a. Stainless-Steel Sheet: ASTM A 240/A 240M, austenitic stainless steel, type as indicated.
   4. Stainless-Steel Finish: Directional satin finish, No. 4.

K. Stainless-Steel Wall Shelf: K-14
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: PS-18-72
      b. Or approved equal.
   2. Description: Snap-n-Slide Wall Shelf with Rolled Front Edge
      a. Materials: 14 gauge, 304 stainless steel with satin finish.
      b. Front rolled edge with 1 1/2" upturn on rear and ends
      c. Dimensions: 48inches long by 15 inches wide, with 10-1/2 inch deep welded shelf brackets.

L. Stainless-Steel Wire Shelf: K-15
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: EC-2472
      b. Or approved equal.
   2. Description: Chrome Wire Shelving
      a. Materials: Chrome plated.
      b. (4) 5" Rubber casters (2 with brakes) Model EC-25
      c. Dimensions: 72 inches long by 24 inches wide, Height 86 inches.
      d. NSF Approved for dry storage.

M. Stainless-Steel Wire Shelf: K-16
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco: EC-2442
      b. Or approved equal.
   2. Description: Chrome Wire Shelving
      a. Materials: Chrome plated.
      b. (4) 5" Rubber casters (2 with brakes) Model EC-25
      c. Dimensions: 42 inches long by 24 inches wide, Height 86 inches.
      d. NSF Approved for dry storage.

N. Stainless-Steel Clean Dishtable: K-05
   1. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
      a. Advance Tabco : Dishtable Model DTC-S70-36R
      b. or approved equal.
   2. Description: Clean Dishtable. Fabricate units of welded stainless steel, sound deadened.
      a. Materials: 14 gauge, type 304 stainless steel.
      b. Backsplash: 10-1/2 inches tall with 2 inch wide return.
      c. Legs and Feet: Stainless steel tubing legs with adjustable feet.

2.02 COOKING EQUIPMENT

A. Ranges: K-01
   1. Products: Subject to compliance with requirements, provide the following:
      a. Garland GF Series 24" Gas Restaurant Range Model GF24-4L1
      b. or approved equal.
   2. Description:
      a. Top Configuration:
         1) Open-Burner Unit:
            (a) Standard Burners: Four burners and griddle
            (b) Cast iron top and stainless steel griddle cover.
            (c) Stainless Steel Front and Sides
            (d) Stainless Steel 5" Plate rail
            (e) Stainless steel backguard with removable shelf
            (f) 136,000 BTU Garland.

b. Base Configuration:
   1) Space Saver Oven 32,000 Btuh/9.38 kW cast iron "H" style oven burner.
c. Accessories:
   1) 6" Leveling swivel casters with front locking
   2) Stainless steel sides.
   3) Stainless steel back.
   4) 6" stainless steel legs with adjustable feet.
d. Gas Service: Natural gas.

B. Deep Fat Fryers: K-20
1. Products: Subject to compliance with requirements, provide the following:
   a. Dean GF-14
   b. or approved equal.
2. Description: Gas fryer100,000 BTU.
   a. Oil Capacity: 40 lb (20 Liters).
   b. Accessories: multi-volt control
      1) Stainless steel sides.
      2) Stainless steel fry tank.
      3) Stainless steel frypot cover.
      4) Sediment tray.
      5) Twin Fry Baskets: - Full basket.
      6) Quick gas-service disconnect and flexible hose.
   c. Gas Service: Natural gas.

C. Double Convection Ovens: K-19
1. Products: Subject to compliance with requirements, provide the following:
   a. Imperial Electirc Turbo-Flow Model ICVE-2
   b. or approved equal.
2. Description:
   a. Standard and Bakery depth ovens are rated 11 KW.
   b. 10 rack positions
   c. Doors: Extreme duty door system.
   d. Accessories:
      1) Heavy duty casters, set of 4
      2) Stainless steel sides.
      3) Stainless steel back.
      4) Direct connect vent
   e. Electrical Service: Equip unit with plug and 8' cord for service indicated on Drawings.

2.03 SELF-CONTAINED REFRIGERATION EQUIPMENT

A. Refrigerators: K-11
1. Products: Subject to compliance with requirements, provide the following:
   a. True Manufacturing Co. - TS-35-HC
   b. or approved equal
2. Description: Reach-in type.
   a. Exterior Finish: Stainless steel.
   b. Interior Finish: Stainless steel.
   c. Doors: Full length.
   d. Accessories:
      1) 4" swivel Casters.
      2) Stainless steel front, sides, aluminum interior with stainless steel floor.
      3) Re-hinging feature for doors.

4) Botom mount self-contained compressor, 1/3 HP, 115v/60/1, 5.6 amps, NEMA 5-15P, NSF-7, ETL, ENERGY STAR.
5) (3) PE coated wire shelves per section, chrome-plated shelf clips.

e. Electrical Service: Equip unit with plug and cord for service indicated on Drawings.

B. Undercounter Refrigerator: K-17
1. Products: Subject to compliance with requirements, provide the following:
a. Beverage Air WTR67AHC
b. or approved equal.
2. Description: Reach-in type.
a. Exterior Finish: Stainless steel.
b. Interior Finish: Stainless steel.
c. Doors: Double doors.
d. Accessories:
1) 3” Casters, two (2) with brakes standard
2) Additional shelves, and Shelf clips
3) Flat-top with no backsplash (-FLT)
4) Wire shelf divider
e. Electrical Service: Equip unit with plug and 8' cord for service indicated on Drawings

C. Blast Chiller/ Shock Freezer: K-18
1. Products: Subject to compliance with requirements, provide the following:
a. American Panel AP12BCF110-3
b. or approved equal.
2. Description: Reach-in type.
a. Exterior Finish: Stainless steel.
b. Interior Finish: Stainless steel.
c. Doors: Door is hinged on the operator’s left.
d. Accessories:
1) Heavy duty 5” casters, two with brakes
2) Drain line assembly
3) Cabinet Sanitation
e. Electrical Service: Equip unit with plug and 6' cord for service indicated on Drawings

2.04 MISCELLANEOUS EQUIPMENT

A. Dishwasher: K-06
1. Products: Subject to compliance with requirements, provide the following:
a. Champion: DH6000-VHR
b. or approved equal.
2. Description: Electric Commercial Door-Type Dishwasher.
a. Construction: Stainless steel.
b. Wash Motor: 2 HP.
c. Wash Tank Capacity: 10 gal.
d. Wash Pump Capacity: 29gal/hour.
e. Capacity: Up to 40 racks per hour.
f. Power: 480/60/3
g. Dimensions: As indicated on drawings.

B. Waste Receptacle: K-21
1. Products: Subject to compliance with requirements, provide the following:
a. Bobrick B-2280
b. or approved equal.
2. Description: Reach-in type.

a. Exterior Finish: 22-gauge (0.8mm) stainless steel with satin finish.
b. Dimensions: 14-3/8" inches long by 14-3/8" inches wide, Height 29-1/4" inches.

C. Recyle Receptacle: K-22
1. Products: Subject to compliance with requirements, provide the following:
a. Bobrick B-2250
b. or approved equal.
2. Description: Reach-in type.
a. Exterior Finish: 22-gauge (0.8mm) stainless steel with satin finish.
b. Accessories:
1) Stainless Steel Cover: 22-gauge (0.8mm) stainless steel with satin finish
c. Dimensions: 13-3/8" inches long by 13-3/8" inches wide, Height 21-3/8" inches.

2.05 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C 920; silicone. Type S (single component), Grade NS (non-sag), Class 25, Use NT (non-traffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
1. Public Health and Safety Requirements:
a. Sealant is certified for compliance with NSF standards for end-use application indicated.
b. Washed and cured sealant complies with the FDA regulations for use in areas that come in contact with food.
2. Cylindrical Sealant Backing: ASTM C1330, Type C, closed-cell polyethylene, in diameter greater than joint width.

2.06 FINISHES

A. Stainless-Steel Finishes:
1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Powder-Coat Finishes: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install food service equipment level and plumb, according to manufacturer's written instructions.
1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.
1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment until smooth and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and with requirements of authorities having jurisdiction.

D. Install cabinets and similar equipment on bases in a bed of sealant.

E. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

F. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.02 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

3.03 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain food service equipment.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Walk-in site assembled, refrigerators and freezers.

1.02 ACTION SUBMITTALS

A. Manufacturer's Literature and Data: For each type of product indicated below. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   1. Walk-in units, including assembly instructions.
   2. Condensing units, with mounting rack where required.
   3. Unit coolers.
   4. Temperature controls and alarms.
   5. Diagrams and details of piping, wiring and controls.

B. Shop Drawings: For each refrigerated enclosure, manufacturer’s engineered shop drawings showing custom fabricated equipment and installation including:
   1. Plans, elevations, and details: Show wall and ceiling panels, indicate framing and blocking in areas noted on plans and number of panels for identification.
   2. Provide detailed information about actual panel construction and location of framing members. If applicable, provide floor panel layouts.
   3. Product data for cooler/freezer doors and hardware supplied by manufacturer.
   4. Insulation details, utility connections, installation instructions and diagrams.
   5. Base shop drawings on verified field measurements and include contractor’s field verification data.

C. Test Reports:
   1. Operational test reports.
   2. Final field test reports.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit qualifications for manufacturer’s authorized installer, attesting its staff has attended and completed factory installation training curriculum.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance and operating manuals in accordance with Section 017823 - TV MOUNTING BRACKETS.

1.05 WARRANTY

A. Insulated Panel Warranty: Provide manufacturer’s written warranty for a period of ten (10) years after date of installation to the Owner.

B. Accessories and components: All accessories and components shall have a one (1) year warranty.

C. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within five (5) years from the date of final acceptance by Owner. Failure includes but is not limited to inability to maintain set temperature.

D. Installer's Warranty: A one (1) year labor warranty of the system is to be provided by the licensed installation contractor as a subcontractor to the kitchen equipment contractor.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS:

A. NSF Standards: Provide equipment that bears NSF Certification Mark certifying compliance with applicable standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:
   1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
   2. NFPA 70, "National Electric Code."

2.02 WALK-IN REFRIGERATOR/FREEZER CONSTRUCTION:

A. General: Walk-in units shall be constructed of pre-fabricated modular panels as manufactured by American Panel Corporation, Ocala, Florida in exact size and shape as shown on plan. Structure's finished height shall be 0'-0" above finished floor. They shall be designed for easy and accurate field assembly, future enlargement by the addition of panels or dismantling should relocation to an alternate site be desired. Construction shall be in strict compliance with NSF Standard 7.

B. Provide walk-in units manufactured for food service use conforming to NSF/ANSI 7, UL 207, and UL 471. Floor panel walk-in refrigerators and freezers with appropriate insulated floor assembly and polished aluminum finish floor.

C. Panel Construction:
   1. General: Panels shall consist of interior and exterior metal surfaces precision formed to exact dimensions with double 90° edges to enhance overall panel rigidity.
      a. Panel dimensions shall be 4" thick and will be provided in 11 ½", 23", 34 ½" and 46" widths to conform to project drawings.
      b. 4" thick panels must meet performance standards as outlined in U. S. Government HR-6 legislation.
      c. Finished panels (not just the core material) shall be listed by Underwriters Laboratories as a Class 1 (UL 723) building unit and demonstrate a flame spread rating of 20 or less. The core material smoke developed Underwriters Laboratory rating shall be no greater than 300 as documented by and in accordance with ASTM E84 Standards.
      d. All panels shall be interchangeable with like panels or standard door frame sections for fast and easy assembly.
   2. Corner panels shall be one piece 90° angled construction and shall measure 12" x 12" or 12" x 6 ¼" where required.
   3. For units with multiple compartments, specially designed "tee" panels shall be provided to form partition wall to outside wall junctures. "Tee" panels shall measure 23" x 12" or 23" x 6 ¼" where required.
   4. Panel edges: Panel edges shall have a molded urethane tongue and groove profile of insulation factor equal to core material to accurately align panels during installation and to assure an airtight seal.
      a. No structural wood, steel, straps, high density urethane or other lesser-insulating materials shall be used in panel construction.

5. Door Panel and Door:
   a. Entrance doors are constructed similar to other panels and shall be flush mount, magnetic in-fitting type.
   b. All pultrusions shall be non-conductive, non-corrosive, rust proof and listed by the National Sanitation Foundation.
   c. The perimeter of the door and frame shall be built of a fiberglass reinforced polymer (FRP) pultrusion weighing not less than 11 ounces per linear foot.
   d. Door sections shall be constructed to conform to Underwriters Laboratories Standards for electrical safety and shall bear all appropriate U.L. listing labels.
   e. Standard door frame sections 46", 57 ½" or 69" wide shall be equipped with a vapor proof light fixture and globe pre-wired to a pushbutton type light switch with pilot light.
   f. Door frame shall be equipped with flexible bellows type vinyl door gasket with magnetic core and flexible EPDM (ethylene propylene diene monomer) door sweep.
   g. Door jamb shall house a door frame heater circuit and a magnet attracting stainless steel trim strip.
   h. Door hardware:
      1) Door hardware shall be die cast zinc with brushed satin finish.
      2) Doors shall be mounted with two (2) heavy duty cam lift hinges.
      3) Pull handle assembly shall incorporate a keyed cylinder deadbolt style lock provision for owner supplied padlock and an inside safety release to prevent personnel entrapment.
      4) Positive door closing and sealing shall be assisted by a hydraulic closer device to ensure automatic door closure.
      5) Doors shall be equipped with 36" high 1/8" diamond aluminum tread kick plates inside and out as well as a 14"x14" heated view window.
   i. Concealed, energy use selective, anti-sweat heater wire circuit: Provide aluminum braided heater wire to for monitoring and control initiation temperature, termination temperature and percentage of operation time.
   j. Thermometer: Manufacturer's standard, 50 mm (2-inch) minimum diameter, dial type, flush mounted in door panel.
   k. Temperature Alarm: All Doors shall have a digital audio/visual temperature alarm with 115V remote power output or dry contacts, delayed temperature reading to eliminate false "spiked" readings in temperature, adjustable pulsating door heater control and adjustable auto lights off control
6. Floor Panels:
   a. Floor Panel Strength: Capable of withstanding 600 pounds per square foot uniform load.
   b. Prefabricated floor panels shall be of the same construction as wall/ceiling, sealed watertight.
   c. Prefabricated floor panels shall incorporate a fully die formed 1/4" NSF coved radius at all interior floor to wall junctures.
   d. Floor panels shall be equipped with foamed-in-place integral interior ramps, fully welded without overlap, hem or fasteners when and where shown.

D. Panel Insulation: Insulation shall be 4" thick high pressure impingement mixed (HPIM) foamed-in-place urethane, minimum 2.4 lb. per cubic foot density, fully heat cured and bonded to metal finishes. The insulation shall be manufactured using an HFC 245fa expanding agent.
   1. The 20º F thermal conductivity ("K" factor) shall not exceed 0.1232 BTU/Hour/Square Foot/Degree Fahrenheit/Inch of Thickness across the entire width of the panel.
      a. Overall coefficient of heat transfer ("U" factor) shall not be less than 8.117.
      b. Resistance to heat penetration ("R" factor) shall not be less than 32.
   2. The 50º F "K" factor shall not exceed 0.1378 BTU/Hour/Square Foot/Degree Fahrenheit/Inch of Thickness across the entire width of the panel..
      a. Overall coefficient of heat transfer ("U" factor) shall not be less than 7.257.
      b. Resistance to heat penetration ("R" factor) shall not be less than 29.02.

3. The insulation shall have a 97% closed cell structure to prevent absorption of liquids.
4. The finished metal surfaces shall be fitted with a teardrop profile gasket and placed in precision tooled fixtures where they are injected with Foamed-in-Place urethane insulation.
    a. Curing of the insulating core shall take place at a controlled temperature within the foaming fixture to provide permanent adhesion to the metal surfaces, allowing for uniform foam expansion and to maximize finished panel strength.

E. Panel Assembly: Assembly of walk-in shall be accomplished by the use of cam-action locking mechanisms precisely positioned along the outside tongue or groove edges of each panel to exactly correspond with a matching mechanism in the adjacent panel.
1. Cam lock spacing on vertical joints shall not exceed 46” and at junction of vertical and horizontal joints by 23”.
2. Cam locks shall be foamed-in-place and anchored securely in the panel by steel “wings” integral to the lock housing.
3. Cam locks shall be operated through access ports by the use of a hex wrench, thereby, pulling the panels together and establishing an airtight seal.
4. All access ports shall be located on the walk-in interior to facilitate assembly when close to building structures and shall be covered by vinyl snap-in caps after final assembly.

F. Panel Finishes: The interior and exterior finish on panel surfaces is to be manufactured from a combination of the following premium grade materials. The gauge or thickness of the metal material listed is rated prior to embossing.
1. Interior walls and interior ceilings shall be20 ga. stainless steel.
2. Exposed Exterior walls shall be 24 ga. galvanized steel in designer color.
3. Unexposed exterior walls shall be20 ga. stainless steel.
4. Interior floor shall be16 ga. stainless steel #2B finish.
5. Exterior floor and ceiling shall be20 ga. stainless steel.

G. Exposed front of box and interior shall incorporate a 1000 series Boston Retail Bumper System, black in color, complete with aluminum base, flexible vinyl top, vinyl corners and round end caps.

H. Lights: Provide high-efficiency rated two-tube fluorescent lamps in vapor-proof fixtures with safety shields. Provide diffuser and high output ballast appropriate for compartment operating temperature. Lighting must conform with UL 1598.

2.03 REFRIGERATION SYSTEM

A. Condensing units shall be preassembled remote, fully hermetic, air cooled units for outdoor installation as manufactured by Copeland or Tecumseh and shall be supplied with matching Heatcraft evaporators.

B. Condensing units shall be equipped with PSC fan motors and evaporator fans shall utilize the ECM type fan motors.

C. All evaporators shall be equipped with QRC factory mounted from Heatcraft, which includes Electronic expansion valves, superheat control, defrost algorithms and fan cycle control.

D. Medium temp units shall utilize R-448A refrigerant and low temp units shall also utilize R448A. Manufacturer is to calculate heat loads and provide systems with a minimum of 105% of needed capacity to maintain holding temperatures of 35° F in coolers and -10° F in freezers. Calculations shall take into consideration box ambient, refrigeration system ambient, air flow, exposure to sunlight and altitude.

E. Interconnection of refrigeration lines, insulation and electrical wiring shall be accomplished by the appropriate trades and shall be a portion of the kitchen equipment contract.

2.04 REFRIGERATION ACCESSORIES

A. Provide a weatherproof cover, low ambient controls, and a 12” high mounting stand for each outdoor condensing unit.

B. Each refrigeration system shall also be equipped with factory mounted electronic expansion valve, moisture detecting liquid eye, filter drier, digital thermostat control, pressure control.

C. Low temp units also are to include factory mounted heat exchangers and evaporator drain line heaters.

2.05 MONITORING ALARM SYSTEM

A. Provide an electronic monitoring and alarm system (WIMS-100) for each section of each unit.
   1. System to have a 5-digit LED display with high and low alarm set points with audible and visual alerts for alarm conditions. All functions shall be programmable and accessible from the face of the controller.
   2. System shall have an integrated, push button light switch with on/off indicator light.
   3. System shall comply with Jan 1, 2009 federal energy requirements by incorporating an automatic lighting shut-off.
   4. System shall actively monitor and control door heater assembly for proper operation and lower energy consumption by having programmable initiation temperature, termination temperature and percentage of operation time adjustability.
   5. System to have 115V output for connection to external alarms, dialers, etc. that run on standard 115V input.
   6. Where specified, the system shall be supplied with a dry contact kit for connection to equipment that requires dry contacts.

2.06 EQUIPMENT IDENTIFICATION REQUIREMENTS:

A. Refer to Section 230010 - GENERAL MECHANICAL REQUIREMENTS.

B. Identify all walk-ins, refrigeration equipment and alarm devices.

2.07 SPECIAL REQUIREMENTS FOR FREEZERS:

A. Provide entrance to freezers through a refrigerator of a higher temperature. Locate thermometer serving frozen freezer outside of higher temperature refrigerator used as entrance vestibule.

PART 3 - EXECUTION

3.01 PREPARATION

A. Do not install items that show visual evidence of biological growth. Prior to commencement of installation, perform a complete walkthrough of the facility with the Owner to verify readiness for installation.

B. Provide adequate protection of all finished surfaces, fixtures, furnishings and other equipment to prevent any damage during the installation work.

3.02 INSTALLATION

A. Conduct installation procedures in accordance with ANSI/ASHRAE 15 & 34, ASHRAE 189.1, NSF Food Equipment and UL standards stated herein.

B. Assemble walk-in units and install refrigeration equipment as described in the manufacturer's instructions. Make panel joints tight and seal all panel penetrations to prevent condensation or frosting.
   1. Unit cooler: NSF approval requires that the unit be suspended at 90 mm (3-1/2 inches) minimum distance below the ceiling to allow cleaning the top of the unit cooler.
   2. Mount pipe, conduit, and instrumentation on the exterior and pass thru neatly drilled penetrations to the lights or other devices.

C. Piping, Pipe Insulation and Refrigerant: Provide in accordance with Section 232300 - REFRIGERANT PIPING.
   1. Tag all plumbing final connection points of equipment, indicating item number, name of devices or components, and type of utility (water, gas, steam, drain). Provide extensions of indirect waste fitting to open-sight hub drain, floor sink, or floor drains from food service equipment.

D. Equipment Connections: Complete equipment connections for all utilities.

E. Controls Installation: As specified in Section 230923 - AUTOMATIC TEMPERATURE CONTROLS AND BUILDING AUTOMATION SYSTEM.

3.03 REFRIGERATOR/FREEZER START-UP, AND PERFORMANCE TESTS AND INSTRUCTIONS

A. Initial Start-up and Operational Test: Perform the tests as specified. Notify Owner and Architect in writing, ten (10) days prior to performing tests. Perform tests in the presence of the manufacturer's representative, Owner and Architect/Engineer.
   1. Provide all lubricants and accessories before initial start-up. Start and operate all equipment.
   2. Follow the manufacturer’s procedures and place the systems under all modes of operation.
   3. Supplement initial charges of lubricating oil to assure maximum operating capacity.
   4. Adjust all safety and automatic control instruments. Record manufacturer’s recommended readings hourly.
   5. Operational tests must cover a period of not less than three (3) days. Submit operational test report.

B. Test Reports: Submit the final field test reports for each system tested, describing test apparatus, instrumentation calculations, and equipment data based on industry standard forms. Include in data:
   1. Compressor suction and discharge pressure;
   2. Refrigerant charge pump,
   3. Compressor and air moving device ampere readings.
   4. Power supply characteristics, including phase imbalance, with 1/2 percent accuracy.
   5. Thermostatic expansion valve superheat-value as determined by field test.
   6. Sub-cooling.
   7. High and low refrigerant temperature switch set-points.
   8. Monitoring alarm system.
   9. Low oil pressure switch set-point.
   10. Defrost system timer and thermostat set-points.
   11. Moisture content.
   12. Ambient, condensing and coolant temperatures.
   13. Capacity control set-points.
   14. Field data and adjustments which affect unit performance and energy consumption.
   15. Where final adjustments and settings cannot be permanently marked or drilled and pinned as an integral part of device, include adjustment and setting data in test report.

C. By arrangement with the Contracting Officer Representative (COR), 24 hours in advance, use the start-up and test period for required operation and maintenance instructions to Owner in accordance with Section 017900 - DEMONSTRATION AND TRAINING.

END OF SECTION

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 TV mounting brackets and associated equipment racks.

B. Related Sections:
   1. Section 061000 - Rough Carpentry for wood blocking

1.03 STANDARDS

A. All work of this Section shall conform to industry standards and/or manufacturer's recommendations.

1.04 SUBMITTALS

A. Pursuant to Section 013300 - Submittal Procedures.

B. Pursuant to Section 016000 - Product Requirements.

C. Manufacturer's cut sheets for each different model.

1.05 QUALITY ASSURANCE

A. All work of this section shall be performed by experienced workers familiar with the work and according to manufacturer's recommendations and/or industry standards.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pursuant to manufacturers published instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURER:

A. Legrand AV Inc., 6436 City West Parkway, Eden Prairie, MN 55344, Phone: 800-359-5520, www.sanus.com or Architect Approved equivalent.
   1. Sanus Brand

2.02 TV TYPES

A. Articulating Flat Panel Wall Mounts
   1. SANUS Advanced Full-Motion Premium TV Mount Model VLF728 - Black

B. Tilting Flat Panel Wall Mounts
   1. SANUS Tilting Wall Mount Model VMPL50A - Black

2.03 EQUIPMENT SHELF

A. SANUS VMA401 On-wall Component Shelf.

B. Single tempered glass shelf, 18" W x 6-1/2" H x 14-5/8" D

C. Provide one (1) at each TV mounting bracket.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate installation with electrical and cable TV cabling.

B. Mount securely in strict accordance with manufacturer's instructions. Solid wood blocking must be provided in GWB walls at all TV location brackets and at all equipment racks.

C. Verify that mounting will support the maximum weight allowable for the unit by the manufacturer but not less than twice the weight of the television.

3.02 ADJUSTMENT AND CLEANING

A. Adjust for smooth operation. Thoroughly clean off all construction dirt and packaging. Do not remove manufacturer's instruction labels or maximum capacity warning labels.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horticulture Work Tables.

1.02 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 A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

1.03 SUBMITTALS

A. See Section 013300 - SUBMITTALS, for submittal procedures.

B. Shop Drawings: Indicate equipment locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, installation and servicing clearances required.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stainless Steel Worktables
   1. Advance Tabco: SPEC-LINE Series; customer@advancetabco.com

2. Architect approved equivalent.

2.02 WORK TABLES

A. Horticulture Work Tables: VSS SERIES - Stainless Steel, Flat Top, Undershelf Style. NSF approved.
   1. Top is furnished with a 2” x 1” square die embossed NO-DRIP countertop edge with a 1/2” return on 4 sides. 14 gauge stainless steel, Type 304 series. All TIG welded. Exposed welds polished to match adjacent surfaces. Top is polished to a satin finish. Countertop edge polished to a Mirror finish. Top is sound deadened.
   2. Hat channel reinforcing: Two locations for 24 inch wide tables and Three locations for 30 and 36 inch wide Tables.
   3. Shelf: 18 gauge stainless steel.
   4. Pre-engineered welded angle adapters insure ease of future drawer installation.
   5. Aluminum die cast “leg-to-shelf” clamp secures shelf to leg eliminating unsightly nuts & bolts. Undershelf is adjustable.
   6. Gussets welded to support hat sections.
   7. Legs: 1 5/8” diameter tubular, 16 gauge stainless steel, Type 304 series. 1 inch adjustable stainless steel bullet feet.
   8. Table Sizes: As indicated or as scheduled on the drawings.

2.03 MATERIALS

A. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304 and 316, stretcher-leveled standard of flatness.

B. Fasteners: Stainless-steel, or other corrosion-resistant materials, standard with the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, 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.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with standards required by authority having jurisdiction.

C. Large Components: Ensure that large components can be moved into final position without damage to other construction.

D. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect/Engineer.

3.03 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Final Acceptance: Remove labels, fingerprints, and clean all surfaces both inside and out. Repair any marred or damaged surfaces that affect appearance, such as both interior and exterior of cabinets in a manner acceptable to Owner. Replace any parts that cannot be repaired in such a manner.

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. Dance Ballet Barre Equipment.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for Dance Ballet Barres. Include plans, elevations, sections, details, anchoring and mounting requirements, attachments to other work, and the following:

1.04 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings and construction contiguous with Dance Ballet Barres by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 BALLET BARRE EQUIPMENT

A. Manufacturer:
   1. Basis of Design: American Harlequin Corporation.
      American Harlequin Corporation
      1531 Glen Avenue
      Moorestown, New Jersey 08057
      Tel.:800.642.6440
      Email: contact@harlequinfloors.com
   2. Architect approved equivalent.

B. Ballet Barres:
   1. Mounting: Free-Standing, Wall Mounted, and Floor Mounted as indicated or scheduled on the drawings.
   2. Type: Fixed, Single Barre and Fixed Double Barre as indicated or scheduled on the drawings.
   3. Length(s): Four (4) feet / Two (2) Brackets, Six (6) feet / Two (2) Brackets, Eight (8) feet / Two (2) Brackets, Ten (10) feet / Two (2) Brackets, Fourteen (14) feet / Three (3) Brackets, and Sixteen (16) feet / Three (3) Brackets as indicated or scheduled on the drawings.
   4. Barre Material: Chrome Plated Steel, Stainless Steel, Powder Coated Steel, Poplar, Red Oak, and White Maple as indicated or scheduled on the drawings.
   5. Barre Diameter: 1 15/16 inches.
   6. Bracket Material: Powder Coated Steel (Black)
   7. Mounting heights:
      a. Single Barre: 32 inches to 46 inches above the floor as indicated or scheduled on the drawings.
      b. Double Barre: 32 inches to 34 inches (Lower Barre) and 44 inches to 46 inches (upper barre) as indicated or scheduled on the drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting installation and use of barre equipment. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.

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

3.02 INSTALLATION, GENERAL

A. Install barre equipment per manufacturer and fabricator's written instructions and approved shop drawings.

B. Installer Qualifications: A Company with a minimum of five (5) years' experience installing similar barre equipment.

C. Under no circumstances shall any product be installed in a manner inconsistent with the manufacturers design intent.

D. Preparation: barre equipment Contractor is responsible for becoming familiar with and verifying pertinent dimensions and conditions, both on Drawings and in the Field, before proceeding with the Work.

E. Protect stage floor from both structural and cosmetic damage.

3.03 DEMONSTRATION AND CLOSEOUT SUBMITTALS

A. Record Drawings: Provide three (3) sets of "as-built" shop drawings.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Window shades and accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 092116 - Gypsum Board Assemblies: Substrate for window shade systems.

C. Section 095100 - Acoustical Ceilings: Shade Pockets, pocket closures and accessories.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 012100 - Allowances, for cash allowances affecting this section.

1.04 REFERENCE STANDARDS

A. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2019.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

C. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.

C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken.
   2. Do not install shades until final surface finishes and painting are complete.

1.06 SUBMITTALS

A. See Section 013300 - SHEET METAL WORK, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

E. Selection Samples: Include fabric samples in full range of available colors and patterns.

F. Samples:
   1. Minimum size 6 inches square, representing actual materials, color and pattern of each shade type material.
   2. Metal finishes: 2 inch square samples of entire color offering for selection by the Architect.

G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum 5 years of documented experience.

1.08 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade complete with selected shade fabric including sample of seam when applicable.
   1. Obtain Architect/Engineer's approval of light and privacy characteristics of fabric prior to fabrication.
   2. Full-sized mock-up will become the property of the Owner to be used for spare parts.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Schedule delivery after building is enclosed and construction is Substantially Complete.

B. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

C. Handle and store shades in accordance with manufacturer's recommendations.

1.10 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: One year.
   3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manually Operated, Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade XD - Dual Roller type shade systems: www.draperinc.com/sle.
   2. Mecho Systems Dual Roller type shade systems.
   3. Architect approved equivalent
   4. Substitutions: See Section 016100 - Product Requirements and Section 012500 - Substitution Procedures.

B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 WINDOW SHADE APPLICATIONS

A. Shades at windows as indicated:
   1. Type: Roller shades.
   2. Fabric: As selected by the Architect from the manufacturer's full line of fabrics..
   3. Color: As selected by Architect/Engineer from manufacturer’s full range of colors.
   4. Mounting: Inside and outside, where indicated on drawings.
   5. Operation: Manual.

2.03 DUAL ROLLER SHADES

A. Roller Shades Type RS-1 - Basis of Design: MechoShade Systems LLC; www.mechoshade.com/#sle.
   1. Description: Double roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Mounting: Recess Mounted in ceiling and wall mounted as indicated in drawings.
      c. Size: As indicated on drawings.
      d. Fabric: As indicated on the Shade Schedule on the drawings.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Double Roller Brackets: Configured for light-filtering and room-darkening shades in one opening.
         1) Light-Filtering Fabric: Room-side of opening.
         2) Room-Darkening Fabric: Glass-side of opening.
   3. Roller Tubes:
      a. Material: Extruded aluminum.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
      a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
      b. Room-Darkening Shades: Provide a slot in bottom bar with wool-pile light seal.
   5. Accessories:
      a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.

1) Fascia to be capable of installation across two or more shade bands in one piece.
2) Color: As indicated on the Shade Schedule or as selected by the Architect..
3) Profile: Square.
4) Configuration: Captured and continuous, as indicated on drawings.

b. Ceiling Pockets: Premanufactured metal shade pocket with removable closure panel, for recess mounting in acoustical tile or drywall ceilings; size and configuration as indicated on drawings.

c. Room-Darkening Channels, Standard: Extruded aluminum side and center channels with brush pile edge seals, SnapLoc mounting base, and concealed fasteners. Channels to accept one-piece exposed blackout hembar to assure side light control and sill light control.

2.04 ACCESSORIES

A. Endcaps: 1028 steel stamping. Complete with adapter roller bracket. Installs to wall or ceiling. Accepts fascia.

B. Nominal size: 4-3/4 inches deep by 7 inches high by length required by window opening, with a return of 1-11/16 inches.

C. Fascias: Size as required to conceal dual shade mounting.
1. Fascia: L-shaped cover of extruded aluminum, 0.060 wall. Assembly snaps onto endcaps without exposed fasteners. Clear Anodized (standard) or color powder coat finish as selected by the Architect / Owner.
2. Style: As selected by Architect/Engineer from shade manufacturer’s full selection.

D. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.

E. Pocket Head Box Installation:
1. Housing case:
a. Rectangular enclosure for two rollers fabricated from 18 Gauge steel with white paint finish.
b. Housing designed to be installed separately from shade as part of ceiling system installation. Shade and operating mechanism can be site installed later after construction operations that might damage shade are complete.
c. Nominal size: 6-1/2 inches wide by 8-1/2 inches deep by length required by window opening.
d. Closure panel: Extruded aluminum bottom closure panel forms slot for passage of shades and is removable for access to shades and operating mechanisms.

F. Number Plates: Number each opening and shade. Provide aluminum number plates for each shade unit and each opening. Fasten shade plate to the back of roller. Fasten opening plate on unexposed surface of the opening.

G. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

H. Rescue Window Labels: One window and associated shade per classroom or teaching area shall be deemed a "rescue window", for egress in case of emergency. All rescue windows shall comply with SED regulations and applicable codes and shall include a conforming label. At a minimum, provide the following:
1. Letters: bright yellow background with black letters
2. Label size: 3 inches high by 5 inches wide
3. Text: the words "RESCUE WINDOW" must be visible from Interior and Exterior sides of each rescue window.

4. Any window treatment/coverings at each of these locations must also have labels.
5. Visible window operating instructions shall be provided if operation is not readily apparent.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
3. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.

C. Dimensional Tolerances: As recommended in writing by manufacturer.

D. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect/Engineer of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Field verify window dimensions prior to fabrication.

B. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

C. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Installation Tolerances:
1. Maximum Offset From Level: 1/16 inch (1.5 mm).

C. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

B. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 2 PRODUCTS

1.01 FABRICATION

1.02 MATERIALS

A. General: Manufacturer's standard materials for units specified, unless otherwise indicated.

END OF SECTION

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, but not limit to, the following:
   1. Wall and Base Cabinets
   2. Radiant Tubing Manifold Cabinets

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Section 061000 - Rough Carpentry for blocking within walls to adequately support casework.
   2. Section 079200 - Sealants for caulking of casework abutting walls.
   3. Section 092116 - Gypsum Board Assemblies.

1.03 STANDARDS

A. All work of this section shall conform to industry standards and/or manufacturer’s recommendations.

1.04 SUBMITTALS

A. Submit pursuant to Section 013300 - Submittal Procedures.

B. Submit pursuant to Section 016000 - Product Requirements.

C. Product Data: Submit manufacturer's technical product data and installation instructions indicating materials, hardware, and finishes used in fabrication of cabinets, as required to show compliance with specifications.

D. Shop Drawings: Submit shop drawings indicating location and size of each type of cabinet, accessories, materials, finishes, hardware types and locations, fillers, etc. Include fully dimensioned plans and elevations and indicate details of anchorage to countertop and to walls.

E. Samples: Provide two 6”x6” samples of stainless steel showing the finish to be provided.

1.05 QUALITY ASSURANCE

A. All work of this section shall be performed by experienced workers familiar with the work and according to manufacturers' recommendations and/or industry standards.

B. Verify casework dimensions to field measurements.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pursuant to manufacturers published instructions.

B. Protect against moisture exposure and damage.

C. Protect cabinets during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

D. Do not deliver cabinets until painting, wet work, grinding and similar operations, which could be performed before installation of cabinets, have been completed in installation areas.

1.07 JOB CONDITIONS

A. Conditioning: Comply with cabinet manufacturer's recommendations for temperature and humidity requirements in cabinet installation areas. Do not install cabinets and countertops until required temperature and relative humidity have been stabilized and will be maintained in installed areas.

B. Maintain temperature and humidity in installation areas as required to maintain moisture content of installed cabinet work within a tolerance range of the optimum moisture content acceptable to cabinet manufacturer, from date of installation through remainder of construction period.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Design, materials, construction and finish of casework specified is the minimum acceptable standard of quality for stainless steel casework. The basis of this specification is Danver Stainless Steel Cabinetry, 1 Grand Street, Wallingford, CT 06492, 203-699-6816 or Architect approved equivalent.

2.02 CASEWORK MATERIALS

A. Sheet steel: Mild, cold rolled and leveled #304 stainless steel. (#4 brushed vertical grain on all exposed surfaces).

B. Minimum gauges:
   1. 20 gauge: Solid door interior panels, drawer fronts, scribing strips, filler panels, enclosures, drawer bodies, shelves, security panels and sloping tops.
   2. 18 gauge: Case tops, ends, bottoms, bases, backs, vertical posts, uprights, glazed door members, door exterior panels and access panels.
   3. 16 gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
   4. 14 gauge: Drawer suspensions, door and case hinge reinforcements and front corner reinforcements.
   5. 11 gauge: Table leg corner brackets and gussets for leveling screws.

C. All spot welds shall be ground smooth, cleaned and polished with no visible markings or grind marks.

2.03 CASEWORK FABRICATION

A. Base Unit and Cases:
   1. Base units and wall cases up to 40” high: End panels and back reinforced with internal reinforcing front and rear posts.
   2. Cases higher than 40”: Formed end panels with front and rear reinforcing post channels; back shall be formed stainless steel panel, recessed ¾” for mounting purposes.
   3. Posts: Front posts fully closed with full height reinforcing upright. Shelf adjustment holes in front and rear posts shall be perfectly aligned for level setting, adjustable to ½” o.c.
   4. Secure intersection of case members with spot and arc welds. Provide gusset reinforcement at front corners.
   5. Base unit backs: Provide fixed backs at all base, drawer and wall units. No access to services behind.

6. Bottoms: Base units shall have one-piece bottom with front edge formed into front rail, rabbeted as required for swinging doors and drawer and flush design for sliding doors.
7. Top rails for base units: Interlock with end panels, flush with front of unit.
8. Horizontal intermediate rails: Recessed behind doors and drawer fronts.
9. Base for base units: 4” high x 3” deep with formed steel base and 11-gauge die formed stainless steel gussets at corners. Provide 3/8” diameter leveling screw with integral bottom flange of minimum 0.56 sq. in area at each corner, accessible through openings in toe space.
10. Tops of wall cases: One piece, with front edge formed into front rail.

B. Drawers:
1. Solid panel drawers: ¾” thick, double wall, telescoping box stainless steel construction and sound deadened.
2. Drawer bodies: Bottom and sides formed into one-piece center section with bottom and sides coved and formed top edges. Front and back panels spot welded to center section.
3. Drawer suspension: SEFA 8 Accuride (or equal) 150-pound full extension drawer slides, stainless steel.
4. Provide drawer with rubber bumpers. Friction centering devices are not acceptable.

C. Doors:
1. Solid panel doors: ¾” thick, double wall, telescoping box stainless steel construction with interior polished and sound deadened. Reinforce interior of front panel with welded stainless-steel hat channels. Hinges with screws to internal 14 gauge reinforcing in case and door. Hinges shall be removable; welding of hinges is not acceptable. Doors shall close against rubber bumpers.

D. Shelves:
1. Form front and back edges down and back ¾”. Form ends down ¾”.
2. Reinforce shelves over 36” long with hat channel reinforcement the full width of shelf.

E. Base molding: 4” high, to be furnished and installed by flooring contractor.

F. Hardware:
1. Drawer and hinged door pulls: Stainless steel wire pull - screws attached on 4” centers.
2. Hinges: Institutional type, five knuckle projecting barrel hinges, minimum 2 - ½” long, type 302 or 304 stainless steel. Provide two hinges for doors up to 36” high; three hinges for doors over 36” high. Drill each leaf for three stainless steel screw attachment to door and frame.
3. Door catches: Adjustable type, spring actuated nylon roller catches.
4. Shelf clips: Die formed, stainless steel designed to engage in shelf adjustment holes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Casework installation:
1. Set casework components plumb, square, and straight with no distortion and securely anchored to building structure. Shim as required using concealed shims.
2. Bolt continuous cabinets together with joints flush, tight and uniform, and with alignment of adjacent units within 1/16” tolerance.
3. Secure wall cabinets to solid supporting material, not to plaster, lath or gypsum board.
4. Abut top edge surfaces in one true plane. Provide flush joints not to exceed 1/8” between top units.

B. Accessory installation: Install accessories and fittings in accordance with manufacturer’s recommendations. Turn screws to seat flat; do not drive.

3.02 ADJUSTING

A. Repair or remove and replace defective work, as directed by Architect upon completion of installation.

B. Make final adjustments to doors and drawers. Doors shall swing freely, catches shall hold securely, and all doors shall be aligned both vertically and horizontally. Drawers shall open and close smoothly, without binding and without excessive side play.

3.03 CLEANING

A. Clean shop finished casework, repair as required.

3.04 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of casework form exposure to other construction activity.

B. Advise contractor of procedures and precautions for protection of installed casework from damage by work of other trades.

END OF SECTION

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.

B. Section 088000 - Glazing

C. Section 092116 - Gypsum Board Systems

1.02 SCOPE

A. Furnish labor and materials necessary to install a complete system.

B. Display Case and Shelving.

1.03 STANDARDS

A. All work of this section shall conform to industry standards and/or manufacturer’s recommendations.

B. Cabinet Standard: ANSI A161.1.

1.04 SUBMITTALS

A. Pursuant to Section 013300 - Submittal Procedures.

B. Pursuant to Section 016000 - Product Requirements.

C. Product Data: Submit manufacturer's technical product data and installation instructions indicating materials, hardware, and finishes used in fabrication of display case, as required to show compliance with specifications.

D. Shop Drawings: Submit shop drawings indicating location and size of each display case, accessories, materials, finishes, hardware types and locations, fillers, etc. Include fully dimensioned plans and elevations and indicate details of anchorage to walls.

1.05 QUALITY ASSURANCE

A. All work of this section shall be performed by experienced workers familiar with the work and according to manufacturer’s recommendations and/or industry standards.

B. Verify display case dimensions to field measurements.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Pursuant to manufacturers’ published instructions.

B. Protect against moisture exposure and damage.

C. Protect material during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

D. Do not install display case until painting, wet work, grinding and similar operations, which could be performed before installation of display case, have been completed in installation areas.

1.07 JOB CONDITIONS

A. Conditioning: Comply with manufacturer's recommendations for temperature and humidity requirements in installation areas. Do not install display cases until required temperature and relative humidity have been stabilized and will be maintained in installed areas.

B. Maintain temperature and humidity in installation areas as required to maintain moisture content of installed display case work within a tolerance range of the optimum moisture content acceptable to cabinet manufacturer, from date of installation through remainder of construction period.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Glass Doors:
   1. Door Glazing: 1/4” Tempered.
   2. Hardware:
      a. Aluminum sliding door tracks: Item No. P1092 ANOD as manufacture by Knape & Vogt Manufacturing Company, 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505, Phone 800-253-1561.
      b. Lock: Item No. 962 as manufactured by Knape & Vogt Manufacturing Company, 2700 Oak Industrial Drive NE, Grand Rapids, MI, 49505 Phone, 800-253-1561.
      c. Ground in pull.

B. Glass Shelves:
   1. Glass Shelving: ¼” Tempered:
   2. Hardware:
      a. Standards: Item No. 87 as manufacture by Knape & Vogt Manufacturing Company, 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505. Phone 800-253-1561.
      b. Brackets Item No. 187 as manufacture by Knape & Vogt Manufacturing Company, 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505 Phone 800-253-1561.

C. Mirror: ¼” Thick - See Section 088000 - Glazing, Paragraph 2.03 Mirrors, for additional information.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect substrate and conditions under which display cases are to be installed.

3.02 BLOCKING

A. Contractor shall provide blocking in walls for display case standards and other required supports.

3.03 INSTALLATION

A. Install display case plumb, level, true and straight with no distortions.

B. Complete hardware installation and adjust for proper operation.

C. Provide standards located 8” from the ends of each shelf and at a maximum spacing of 24” o.c. Standards shall run full height of display case.

D. Provide shelving brackets as required for a complete installation.

E. Butt mirror to standards. Mirror seams to conform to standard's spacing. Standards shall run full height of display case.

F. Glue mirror to gypsum wall boards per adhesive manufacture recommendations.

3.04 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed upon completion of installation.

B. Clean exposed and semi-exposed surfaces, touch-up as required. Remove and refinish damaged or soiled areas.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Epoxy resin worksurfaces and accessories.
   2. Setting materials.

B. Related Sections:
   1. Division 01: Administrative, procedural, and temporary work requirements.
   2. Section 061000 - Rough Carpentry
   3. Section 079200 - Joint Sealers
   4. Section 064100 - Architectural Wood Cabinets
   5. Section 123400 - Manufactured Plastic Casework
   6. Section 123500 - Specialty Casework
   7. Section 224000 - Plumbing Fixtures

1.02 REFERENCES

A. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2018).

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

C. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 2018.

D. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics; 2015.

E. 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.

F. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008 (Reapproved 2015).

G. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.

H. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2020.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2022.

J. ISO 9001 - Quality Management Systems — Requirements; 2015.

K. NSF 51 - Food Equipment Materials; 2021.

L. SCS (CPD) - SCS Certified Products; Current Edition.

M. SEFA 3 - Laboratory Work Surfaces; 2010.

N. GREENGUARD Environmental Institute (GREENGUARD):
   1. Indoor Air Quality Certification Program.
   2. Children and Schools Certification Program.

O. International Organization for Standardization ISO 9001 - Quality Management Systems - Requirements.

P. NSF International / American National Standards Institute NSF 51 - Food Equipment Materials.

Q. Scientific Certification Systems SCS (CPD)- Recycled Content Certifications.
   1. Scientific Equipment and Furniture Association SEFA 3 - Work Surfaces.

1.03 SUBMITTALS

A. Submittals for Review:
   1. Shop Drawings:
      a. Submit plan, section, elevation and perspective drawings necessary to describe and convey layout, profiles, and product components, including edge conditions, joints, fitting and fixture locations, anchorage, accessories, and finish colors.
      b. Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on Shop Drawings.
      c. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.
   2. Product Data: Manufacturer's data sheets on each product to be used, including:
      a. Preparation instructions and recommendations.
      b. Storage and handling requirements and recommendations.
      c. Installation methods.
   3. Samples:
      a. Selection samples: For each finish product specified, submit complete set of color chips representing manufacturer's full range of standard colors.
      b. Verification samples: For each finish product specified, submit samples representing actual product color; supplied product color and gloss may vary slightly from supplied samples.

B. Quality Control Submittals:
   1. Test Reports: Certified test reports or recognized evaluation reports showing compliance with specified performance characteristics and physical properties.

C. Closeout Submittals:
   1. Maintenance Data:
      a. Provide maintenance, cleaning, and life cycle information.
      b. Include recommended cleaning materials and procedures, and list of materials detrimental to epoxy resin.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Primary products furnished by single manufacturer with minimum [10] [ ] years [documented] experience in work of this Section.
   2. Products manufactured in ISO 9001 certified facility.

B. Installer Qualifications: Minimum three (3) years documented experience in work of this Section.

C. Mockup:
   1. Construct worksurface mockup, six (6) feet wide x full depth.
   2. Include worksurface, and trim.
   3. Locate as directed by the Owner's Construction Representative.
   4. Approved mockup may remain as part of the Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Use pallets larger than sheets during transportation.
   2. Package materials to prevent damage during shipping and handling.

B. Storage:
   1. Store products in enclosed area protected from ultraviolet.
   2. Store products in manufacturer's unopened packaging until ready for installation.
   3. Store panels using protective dividers to avoid damage to surfaces.
   4. For horizontal storage, store sheets on pallets of equal or greater size than sheets with protective layer between pallet and sheet and on top of uppermost sheet.
   5. Do not store sheets or fabricated panels vertically.

C. Handling:
   1. If protective film is provided, do not remove until panel has been installed.
   2. Handle sheets to prevent damage.
   3. Remove stickers immediately after installation.

1.06 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's limits.

B. Avoid direct exposure of products to sunlight.

C. Do not use worksurfaces as bench, ladder, or seating.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Contract Documents are based on products by Durcon, Incorporated, 206 Allison Drive, Taylor, TX 76574, 512-595-8000, www.durcon.com.

B. Architect approved equivalent.

C. Substitutions: See Section 016100 - Product Requirements and Section 012500 - Substitution Procedures.

2.02 MATERIALS

A. Solid Epoxy Resin:
   1. Sheets cast from modified epoxy resin and non-asbestos inert fillers; compounded mixture cured and thermoset specifically from formulation to provide exceptional physical and chemical resistance required in medium to heavy duty laboratory environments.
   2. Sheets cast from modified epoxy resin and non-asbestos inert fillers with 10 percent of filler certified as post-consumer glass by SCS; compounded mixture cured and thermoset specifically from formulation to provide exceptional physical and chemical resistance required in medium to heavy duty laboratory environments.
   3. Sheets monolithic throughout without surface coating application.
   4. Certified to NSF 51.
   5. Certified by GREENGUARD under Indoor Air Quality and Children and Schools Certification Programs.
   6. Physical properties; minimum acceptable physical performance in accordance with SEFA 3 testing procedures:

a. Density/specific gravity: Tested to ASTM D792; minimum test rating of 133.6 lb/ft3 or 2.14 g/cm3.
b. Rockwell hardness: Tested to ASTM D785; minimum M scale rating of 109.
c. Fire resistance: tested to ASTM D635; classified as self-extinguishing.
d. Surface burning characteristics: Tested to ASTM E84; flame spread index 5 and smoke developed index of 185.
e. Coefficient of linear thermal expansion: Tested to ASTM D696; rating of 1.2 x 10-5 in/in degrees F or 2.15 x 10-5 mm/mm degrees C.
f. Heat deflection: Tested to ASTM D648; maximum 293 degrees F or 145 degrees C .
g. Flexural strength: Tested to ASTM D790; minimum rating 12.6 KPSI or 87 Mpa.
h. Flexural modulus: Tested to ASTM D790; 3240 KPSI or 22.4 mm degrees C.
i. Water absorption, 24 hours: tested to ASTM D570; maximum 0.03% by weight.
j. Compression strength: Tested to ASTM D695; minimum 32.7 kpsi or 226 Mpa.
k. Chemical resistance; minimum acceptable chemical resistance performance in accordance with SEFA 3:

REAGENT TESTED	METHOD	RATING
Amyl Acetate	A	0
Ethyl Acetate	A	0
Acetic Acid, 98%	B	0
Acetone	A	1
Acid Dichromate, 5%	B	0
Butyl Alcohol	A	0
Ethyl Alcohol	A	0
Methyl Alcohol	A	1
Ammonium Hydroxide, 28%	B	0
Benzene	A	1
Carbon Tetrachloride	A	0
Chloroform	A	1
Chromic Acid , 60%	B	0
Cresol	A	0
Dichloracetic Acid	A	0
Dimethyl formamide	A	0
Dioxane	A	0
Ethyl Ether	A	0
Formaldehyde, 37%	A	0
Formic Acid, 90%	B	0
Furfural	A	1
Gasoline	A	0
Hydrochloric Acid, 37%	B	0
Hydrofluoric Acid , 48%	B	0
Hydrogen Peroxide, 28%	B	0
Tincture of Iodine	B	0

Methyl Ethyl Ketone	A	0
Methylene Chloride	A	0
Monochlorobenzene	A	0
Naphthalene	A	0
Nitric Acid , 20%	B	0
Nitric Acid, 30%	B	1
Nitric Acid, 70%	B	1
Phenol, 90%	A	0
Phosphoric Acid, 85%	B	1
Silver Nitrate, Saturated	B	0
Sodium Hydroxide, 10%	B	1
Sodium Hydroxide, 20%	B	1
Sodium Hydroxide, 40%	B	1
Sodium Hydroxide, Flake	B	1
Sodium Sulfide, Saturated	B	2
Sulfuric Acid, 25%	B	1
Sulfuric Acid, 85%	B	2
Sulfuric Acid, 96%	B	3
Sulfuric Acid, 85% & Nitric Acid , 70%, Equal Parts	B	3
Toluene	A	1
Trichloroethylene	A	0
Xylene	A	0
Zinc Chloride, Saturated	B	0

Testing Method Descriptions:

Method A - Volatile chemicals (organic solvents): Cotton ball saturated with test reagent is placed in one-ounce bottle (20 x 75mm test tube or similar container) with reservoir of liquid above ball. Container is inverted on test material for period of 24 hours at standard temperature 23 degrees C plus or minus 2 degrees C (73 degrees F plus or minus 4 degrees F).

Method B - Non Volatile Chemicals: Five drops (1/4 cc) of test reagent are placed on test material surface. Reagent is then covered with watch glass (25 mm) for period of no less than 24 hours at standard temperature of 23 degrees C plus or minus 2 degrees C (73 degrees F plus or minus 4 degrees F).

Result Definitions:

0 - No Effect: No detectible change in material surface.
1 - Good: Slight detectable change in color or gloss but no change to function or life of work surface material. 2 - Fair: Slight surface etching or severe staining. Clearly discernible change in color or gloss but no significant impairment of surface life or function.
2 - Fair: Slight surface etching or severe staining. Clearly discernible change in color or gloss but no significant impairment of surface life or function.
3 - Poor: Pitting, cratering or erosion of work surface material; obvious and significant deterioration. Objectionable change in appearance due to surface discoloration.

B. Color: as indicated on the drawings or as selected by the Architect from the manufacturer's full color offering.

2.03 ACCESSORIES

A. Provide solid epoxy resin laboratory shelving and countertops where indicated.

B. Installation Materials: Manufacturer's joint adhesive, panel adhesive, and sealants as required to suit project conditions.

2.04 FABRICATION

A. Fabricated tops and accessories in accordance with manufacturer's recommendations, approved Shop Drawings, and SEFA 3.

B. Epoxy Resin Worksurfaces:
   1. Thickness: 1-1/4 inches (32 mm) unless indicated otherwise.
      a. Check each approved shop drawing sheet at factory for required thickness.
      b. Maximum variation in thickness: plus or minus 1/16 inch (1.6 mm) from corner to corner.
   2. Warpage:
      a. Inspect tops for warpage prior to fabrication by placing on true flat surface.
      b. Maximum allowable warpage: 1/16 inch (1.5 mm) in 36 inch (900 mm) span or 3/16 inch (4.5 mm) in 96 inch (2400 mm) span.
   3. Fabrication:
      a. Shop fabricate in longest practical lengths.
      b. Bond joints with highly chemical resistant cement with properties and color similar to base material.
      c. Provide 1/8 inch (3 mm) drip groove at underside of exposed edges, set back 1/2 inch (13 mm) from face.
      d. Finish exposed edges.
   4. Fabricate tops as indicated on the drawings at epoxy sink locations.
   5. Edge treatment: As indicated on Drawings.
   6. Corner treatment: exposed corners shall be eased slightly for safety.
   7. Back and end splashes:
      a. Supplied loose for field installation.
      b. Same material and thickness as worksurfaces.
      c. Height: as indicated on the drawings.
      d. Top-mounted end splash where worksurfaces abut adjacent construction at and locations indicated on Drawings.
   8. Joints: Maximum 1/8 inch (2 mm), bonded with epoxy grout.
   9. Make joints between two benches level.
   10. Locate joints away from sinks and over or near supports.
   11. Sink cutouts: As indicated on Drawings.
   12. Allowable tolerances:
      a. Square: Plus or minus 1/64 inch (0.4 mm) for each 12 inches (300 mm) of length.
      b. Location of cutouts and drilled openings: Plus or minus 1/8 inch (3 mm) of design dimension.
      c. Size of cutouts and drilled openings: Plus 1/8 inch (3 mm) or minus 0 inches (0 mm).

C. Epoxy Resin Sinks:
   1. Mold sinks from thermosetting epoxy resin.
   2. Mold interior corners to radius. Slope sink base to drain outlet.
   3. Provide 1-1/2 inch (38 mm) outlet with open ended standpipe; standpipe overflow 2 inches (50 mm) shorter than depth of sink.
   4. Unless otherwise indicated, fabricate sinks of drop-in design supported by upper flange from worksurface.

5. Color: To match adjacent worksurface.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until cabinets have been installed.

B. Confirm that surfaces to receive tops are plumb and level, with maximum deflection of 1/4 inch (6 mm) in 20 feet (6 m).

3.02 PREPARATION

A. Clean surfaces just prior to installation.

B. Prepare surfaces using methods recommended by manufacturer.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.
   1. Install tops plumb and level.

B. Scribe to adjacent surfaces in accordance with manufacturer's recommendations.

C. Fasten tops to supporting construction with adhesives appropriate for use with adjoining construction and as recommended by manufacturer.

D. Form field joints using manufacturer's recommended adhesive. Form joints to be inconspicuous and nonporous.

E. Install countertops and laboratory shelving using fasteners and adhesive appropriate for use with adjoining construction and as recommended by manufacturer.

3.04 PROTECTION

A. Protect installed products until completion of Project.

B. Touch up, repair, or replace damaged products.

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 surface material countertops.
   2. Solid surface material backsplashes and endsplashes.
   3. Solid surface material window sills.

1.03 ACTION SUBMITTALS

A. Comply with Section 013300 - SUBMITTALS.

B. Product Data: For countertop materials.

C. Shop Drawings: For countertops. Show materials, finishes, window sills, edge and backsplash profiles, methods of joining, cutouts and holes, and integral sinks, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops with a minimum of three (3) years of documented installation experience for projects of similar scope, complexity and size. Installer shall be currently certified by the manufacturer as an approved installer.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

1.08 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

1.09 WARRANTY

A. Manufacturer's Limited Warranty: Provide manufacturer's standard Ten(10) - Year Commercial Limited Warranty against defects in solid surface sheet materials.

PART 2 - PRODUCTS

2.01 SOLID SURFACE MATERIALS (SS-1)

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. DuPont de Nemours and Company: Corian.
      b. Wilsonart Contract: Wilsonart Solid Surface.
      c. Architect approved equivalent.
   2. Colors and Patterns: As selected by the Architect from the manufacturer's full color and pattern offering.
   3. Composition: Acrylic resins, fire-retardant mineral fillers, and proprietary coloring agents. Through-the-body color for full thickness of sheet material.
   4. Edge Detail: As indicated on the drawings.
   5. Finish: Polished, with a 60° gloss rating of 55 - 80.
   6. Window Sills: 1 inch thick thick solid surfacing material, adhesively joined with inconspicuous seams, edge details as indicated on Drawings. Color: As selected by the Architect from the manufacture's full, pattern, and finish offering.
   7. Physical Characteristics:

Characteristic	**Test**	**Results**
Tensile Strength:	ASTM D638	6000 psi
Tensile Modulus	ASTM D638	1.5 x 10^6 psi
Tensile Elongation	ASTM D638	0.4 percent minimum
Flexural Strength	ASTM D790	10,000 psi
Flexural Modulus	ASTM D790	1.2 x 10 ^6 psi
Thermal Expansion Coefficient	ASTM D696	1.37 x 10^5 in./in. degree F
Hardness (Barcol Impressor)	ASTM D2583	55-62
Impact Resistance:	NEMA LD 3	144 inch drop - no fracture 12mm slab
Izod Impact: 0.28 (ft-lb.)/in.	ASTM D256 - method A	0.28 ft-lbs/in.
Light Resistance - Xenon	NEMA LD 3, Method 3.3	no effect
Stain Resistance	ANSI 124.3 modified	Pass
Wear and Cleanability	ANSI 124.3 modified	Pass
Fungi Resistance	ASTM G21	Pass
Bacterial Resistance:	ASTM G22	Pass
Boiling Water Resistance:	NEMA LD 3	No effect
High Temperature Resistance:	NEMA LD 3	No effect
Weatherability:	ASTM G155	Delta E less than 5
Moisture Absorption	ASTM D570	Less than .25 percent
Specific Gravity	ASTM D792	1.7 gram/cm^3
Weight		4.4 lbs./sq. ft.
Surface Burning Characteristics	ASTM E84 & UL 723	Class I and Class A
Smoke Developed		less than 25

B. Counter Perimeter Frame: 1/2 inch thick, moisture resistant, 3/4 inch thick exterior grade plywood with waterproof adhesive, Fir or Poplar plywood, veneer core only. Provide fire retardant product contains fire-retardant chemicals injected with raw materials during manufacturing and achieves a maximum flame-spread rating of 25 with a maximum smoke development of 200 when tested to ASTM E84.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade B-C Plugged, touch sanded.

2.02 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Premium.

B. Finish: Ensure surfaces have a uniform finish.
   1. Matte, with a 60° gloss rating of 5 - 20.

C. Fabrication Tolerances:
   1. Variation in Component Size: +/-1/8".
   2. Location of Openings: +/-1/8" from indicated location.

D. Configuration:
   1. Front: Radius edge with apron - 1 1/2 inch high with edge as indicated on the drawings..
   2. Backsplash: 4 inch height, Straight, with 1/4 inch radius top edge and vertical corner edges.
   3. End Splash: None.

E. Countertops: 1 inch thick, solid surface material.

F. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Fabricate with loose backsplashes for field assembly.
   2. Install integral sink bowls in countertops in the shop.

G. Joints: Fabricate countertops without joints.

H. Cutouts and Holes:
   1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
      a. Provide vertical edges, rounded to 3/8-inch radius at juncture of cutout edges with top surface of countertop, slightly eased at bottom, and projecting 3/16 inch (5 mm) into fixture opening.
   2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
   3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.03 INSTALLATION MATERIALS

A. Adhesive: Methacrylate-based adhesive for chemically bonding solid surfacing seams or product recommended by solid surface material manufacturer.
   1. Color complementary to solid surfacing sheet material.

2. Adhesives shall have a VOC content of 70 g/L or less.
3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Product: Wilsonart Hard Surface Adhesive or Architect approved equivalent compatible with the approved material.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 - JOINT SEALANTS.
1. Material shall comply with ASTM C920, Type S (single component), Grade NS (non-sag).
2. Color: Clear or As selected by the Architect from the manufacturer's full color offering

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.02 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into wall cleats. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
1. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 079200 - JOINT SEALANTS.

3.03 SITE QUALITY CONTROL

A. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.04 CLEANING

A. Remove excess adhesive and sealant from visible surfaces.

B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.05 PROTECTION

A. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.

B. Protect surfaces from damage until date of Substantial Completion of the Work.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes the following types of entrance flooring systems:
   1. Floor Grids & Frame Assemblies

1.02 SUBMITTALS

A. General: Submit the following in accordance with conditions of contract and Section 013300 - SUBMITTALS.
   1. Product data for each type of floor grid and frame specified, including manufacturer's specifications and installation instructions.
   2. Shop drawings in sufficient detail showing layout of grid and frame specified including details indicating construction relative to materials, direction of traffic, spline locations, profiles, anchors, and accessories.
   3. Samples for verification purposes: Submit an assembled section of floor grid and frame members with selected tread insert showing each type of color for exposed floor grid, frame and accessories required.
      a. Gridline® G6 4 x 4” standard size sample in Stainless Steel
   4. Maintenance data in the form of manufacturer's printed instructions for cleaning and maintaining floor grids.

1.03 REFERENCES

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 E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

C. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015.

D. ISO 9001 - Quality Management Systems — Requirements; 2015.

E. Flammability in accordance with ASTM E648, Class I, Critical Radiant Flux, minimum 0.45 watts/m2.

F. Standard rolling load performance factory tested at 1000 lb./wheel (load applied to a solid 5” x 2” wide polyurethane wheel, 1000 passes without damage). [Specifier note: For entranceways in businesses such as retail outlets, airports, banks, and casinos, rolling load performance is a critical factor. We recommend that units with the highest practical loading capability be specified for such entrances.]

G. Utilize superior structural stainless steel Type 304 or Type 316 components.

1.04 QUALITY ASSURANCE

A. Most CS mats are designed for traffic crossing perpendicular to the rail. ii) When designing an entranceway it is preferable to minimize the need for turning on the mat. iii) The maximum grid section width is 8’. A large entryway can utilize several sections of grids, but to avoid unsightly split locations, design your entrance flooring with this in mind. Design assistance is available at 1-800-233-8493.

B. Slip resistance in accordance with ASTM D2047, Coefficient of Friction, minimum 0.60 for accessible routes.

C. Flammability in accordance with ASTM E648, Class I, Critical Radiant Flux, minimum 0.45 watts/m2.

D. Single Source Responsibility: Obtain floor grids and frames from one source of a single manufacturer.

E. Stainless Steel Components: Type 304 or type 316.

F. Flatbed fabrication method.

G. Manufacturer Qualifications: ISO 9001 & ISO 14001 certified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

1.06 PROJECT CONDITIONS

A. Field measurements: Check actual openings for grids by accurate field measurements before fabrication. Record actual measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work. Provide manufacturer Factory Template Service ot ensure accurate fabrication.

B. Recessed Conditions: Coordinate preparation and provision of mat recess frames with the Concrete work (Division 03) prior to concrete slab installations. Contractor shall work with the Factory Template Service to provide a coordinated and correctly placed installation. Contractor shall be responsible for any and all remedial work made necessary should this coordination effort is not provided. This remedial may include purchase of a replacement frame and Entrance Grid and slab replacement accordingly.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Construction Specialties, 3 Werner Way, Lebanon NJ 08833 USA 800-233-8493; email: cet@c-sgroup.com.

B. Architect approved equivalent.

C. Substitutions: See Section 012500 - PRODUCT SUBSTITUTION PROCEDURES.

2.02 MATERIALS

A. Stainless steel - Type 304 or Type 316 stainless steel for surface wires and support bars

2.03 FLOOR GRIDS (WM)

A. Model and Description - G6 GridLine - Cradle 2 Cradle Silver certified, shall be manufactured from type 304 stainless steel in 5/8 inch (15.97mm) depth. Wires to be .090" (2.28mm) x.150" (3.81mm) electronically welded and spaced .145 (3.68mm) apart.

1. Unit shall withstand 1000 lb./ wheel loads (load applied to a solid 5" x 2" wide polyurethane wheel, 1000 passes without damage).

2.04 GRID FRAMES

A. Frame Type:
   1. SSA - Stainless Steel Angle Frame shall be 7/8” (22.22mm) deep recess in Type 316 stainless steel with 1/8" (3.2mm) exposed surface.

B. Lock Down Mechanism:
   1. HL - Hidden Lock Down shall be 1 ¼” (31.75mm) x 1 ¼” (31.75mm) x 1/8” (3.175mm), Type 304 or Type 316 stainless steel, welded hold down tabs to secure Gridline to secure surface.

PART 3 - EXECUTION

3.01 EXAMINATION

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. Do not proceed until unsatisfactory conditions have been corrected.

C. Preparation
   1. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped grid assemblies to ensure a proper installation. Specifier note: Stainless steel grids are not field adjustable therefore it is highly recommended that all stainless steel grids be ordered with optional factory template service.
   2. Optional: manufacturer to provide factory supported field measurement to ensure precise installation.

D. Installation
   1. Install the work of this section in strict accordance with the manufacturer's recommendations.
   2. Set grid type at height recommended by manufacturer for most effective cleaning action.
   3. Coordinate top of grid surfaces with bottom of doors that swing across to provide ample clearance between door and grid.

E. Cleaning
   1. Clean the tread surface and recessed well as frequently as possible to reduce the effects of accumulated soiling that may hinder performance and lifetime.

F. Protection
   1. After completing required frame installation and concrete work, provide temporary filler of plywood or fiberboard in recesses, and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and project is near time of substantial completion.
   2. Defer installation of floor grids until time of substantial completion of project.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish, assemble and install furniture and equipment as follows:
   1. Workstations, including lateral files, pedestals, and task chairs.
   2. Bookcases.
   3. Computer desks.
   4. Reading Tables.
   5. Task chairs.
   6. Occasional Table.
   7. Lounge Chairs.
   8. Display cases.
   9. Others as indicated elsewhere in contract documents.

1.02 RELATED SECTIONS

A. Section 096513 - Resilient Tile Flooring and Base.

B. Section 096813 - Carpet Tiles.

C. Section 096816 - Sheet Carpeting.

1.03 QUALITY ASSURANCE:

A. Manufacturer’s Qualifications:
   1. Manufacturer is regularly engaged in design and manufacture of furniture of scope and type similar to requirements of this project for a period of not less than five (5) years.
   2. Manufacturer has successfully completed at least three (3) projects of scope and type similar to requirements of this project.
   3. Submit manufacturer’s qualifications and list of projects.

B. Installer Qualifications:
   1. Installer has completed at least three (3) projects in least five (5) years in which these products were installed.
   2. Submit installer qualifications.

1.04 SUBMITTALS

A. Submit product data of furniture with manufacturer's photographs and features for each item specified, clearly marked with quantities required and finishes for each component.

B. Submit shop drawings showing sizes, gauges, individual parts, and methods of assembly.

C. Samples: Submit samples for initial selection purposes in form of furniture manufacturer's standard color cards, together with a 12-inch square fabric and/or finish sample (one color for each pattern and/or texture) for each item required.

D. Furniture Schedule: Provide a schedule of furniture prepared by or under the supervision of supplier using same reference numbers, include all materials, finishes, colors, patterns, and options. Coordinate with electric and data.

1.05 DELIVERY AND STORAGE

A. Deliver materials in ample time to facilitate the work of this section.

B. All furniture shall be delivered to the job site in individually packed cartons complete with manufacturer's assembly and maintenance instructions.

C. Furniture shall be stored in upright position on wood sills or on floors that will prevent damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furniture shall be designed for commercial application. Products designed for residential use is not acceptable.

2.02 SCHEDULE

A. Provide furniture in accordance with the schedule included at the end of this section and as indicated on Furniture drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All manufactured items shall be installed in accordance with the manufacturer's directions and recommendations.

B. All items shall be left free of blemishes, scratches and other imperfections before acceptance by the Owner.

C. Erect all items neatly, plumb, level, true-to-line, accurately to required position, and with all anchorages highly secure.

D. All colors, textures and patterns shall be selected by the Architect and approved by Owner.

3.02 CLEANING

A. Upon completion of installation, remove all cardboard cartons and packing materials from the premises.

B. All furniture and casework shall be left clean, free from prints, mars or surface imperfections.

C. Replace or repair any damage to previously installed work as a result of the installation of furniture and casework.

Item	Manufacturer	Model	Description	Surface	Finish	Pattern	Color

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Systems furniture.

1.02 RELATED SECTIONS

A. Division 26 - Electrical.

1.03 SUBMITTALS

A. Submit under provisions of Section 013300 - SUBMITTALS.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

D. Verification Samples: For each finish product specified, two samples, representing actual product and finish.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 year experience manufacturing similar products.

B. Installer Qualifications: Minimum 2 year experience installing similar products.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship is approved by Architect.
   3. Refinish mock-up area as required to produce acceptable work.

1.05 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: KI Furniture

B. Requests for substitutions will be considered in accordance with provisions of Section 016100 - BASIC PRODUCT REQUIREMENTS.

2.02 MATERIALS

A. Systems Furniture:
   1. Components:
      a. Panel System
         1) Panels shall be offered in monolithic or segmented styles. All panels ship knockdown with panel frame, tiles, base components, top caps, adjustable glides, and panel-to-panel connection hardware. Panels may be specified without top caps to allow for attachment of spanning top caps or divider screens. Pre-configured panels are 3 1/2” thick and are available in the following dimensions:
            (a) Panel Widths: 24 inch, 30 inch, 36 inch, 42 inch, 48 inch, 54 inch, 60 inch, and 72 inch (features split tiles) .
            (b) Panel Heights: 32 inch, 40 inch, 48 inch, 56 inch, and 64 inch.
         2) Base style shall be:
            (a) Standard Base, Elevated Base, and Tile-to-Floor Base
      b. Frame Construction
         1) Frames are welded, and consist of the following:
            (a) Top & bottom horizontal rail - formed of 16-gauge steel by 1 7/8” square.
            (b) Vertical Post - formed of 16-gauge steel by 1 3/4” x 2 1/16”, featuring slots at 1” increments to allow for tile and component hanging.
            (c) Top cap mounting clip - formed of 20-gauge spring steel by 1 1/4” x 1 7/8” x 2” with channel to route data cables. Fastened with #12 x 3/4” screw to all top horizontal rails.
            (d) Glide housing - Molded plastic rated HB minimum. Overall dimensions are 1 1/8” x 24” x 1 1/2” height. Glides provide a 3” range of adjustment.
            (e) Glide - 3/8-16 x 1” diameter.
            (f) Glide stem - 3/8-16 x 1” diameter.
            (g) Wireway mounting bracket - used on bottom and beltline raceway in powered assemblies. Formed of 16-gauge steel. Overall dimensions are 1 3/8” x 1 13/16” x 2 1/2” with mounting holes for wireway.
         2) Stackable Frames
            (a) Stackable frames shall be 16” height. Stackable frames are constructed in one of two styles:
               (1) Stackable frames for standard two-sided tile attachment feature rails and posts. Stacking frames are attached with 1/4” x 1” x 7 1/2” steel blades.
               (2) Stackable frames with glass or perforated steel inserts consist of full four-sided aluminum horizontal and vertical posts. Frames measure 1/16” x 1 5/16” x 3 1/4”, in overall widths consistent with frame widths.

Frames capture a single 1/4” glass panel or perforated steel segment within, and are attached with 1/4” x 1” x 7 1/2” steel blades.

3) Light Shield
   (a) 90° - Formed of a 1/16” thick extruded black plastic rated HB minimum. Angle is 90° for 90° panel intersections. Lengths range for 48”, 64” and 80”. Other lengths must be field cut from the three listed. Plastic light shields snap to connector blocks at 90° intersection and serve only to block light. Dimensions: 9/16” x 9/16”
   (b) 120° - Formed of 18-gauge, pre-painted black steel. Length ranges from 8” to 80” x 8” increments. Angle is 60° for 120° panel intersections. Steel light shields hang on connector block bolts at 120° intersections. 120° light blocks block light and serve as a spacer for proper floor planning. Dimensions: 2 11/16” x 2 11/16”.
4) Raceway Hinge Clip
   (a) Raceway hinge clip is molded plastic, rated HB minimum. Dimensions: 1 13/16” x 2 1/8” x 3 1/4”.
5) Connector Block
   (a) 90° - Formed by an extruded aluminum square block 1/8” minimum wall thickness includes one threaded steel insert on each face. Block contains two “U” shaped, 18-gauge galvanized steel spacer plates fastened to the block with one 1/4-20 bolt. Dimensions: 2 1/2” x 3 3/8” wide
   (b) 120° - Formed of extruded aluminum triangular block 1/8” minimum wall thickness. Includes three threaded inserts and no spacer plates. Dimensions: 2 1/2” x 2 15/16” wide

c. Tile Inserts
1) Monolithic
   (a) Pre-configured monolithic panels feature either fabric or steel tile inserts.
2) Segmented
   (a) Pre-configured segmented panels are available in a variety of substrates and finish options. Segmented panels universally feature a 32” segmentation height, with specified upper and lower, and front and back tiles. Pre-configured segment options vary by configuration and may include:
      (1) Fabric - upper and lower
      (2) Powder-coated Solid Steel - lower
      (3) Steel Markerboard - upper
      (4) Glass - upper
      (5) Powder-coated Perforated Steel - upper
   (b) Fabric Tiles
      (1) Fabric tiles feature one of two cores:
      (2) Fiberglass - 1/2” thick fiberglass board in dimensions from 24” - 60” wide and 8” - 64” tall; may feature up to two cutouts with overall dimensions 2 1/16” x 75/8” for receptacles.
      (3) Wood Fiberboard - 1/2” thick industrial wood fiberboard, in dimensions from 24” - 48” wide and 8” - 48” tall; may feature up to 2 cutouts, overall dimensions 2 1/16” x 7 5/8” for receptacles.
      (4) Fabric tiles feature 2” stiffener rails of 1/16” formed steel. Rails are secured to the core with adhesive, and are located on left and right vertical edge of tile. Similar rails are adhered horizontally as required for additional rigidity. Fabric is secured to tile edges and back of tile with adhesive. Standard panels with fabric tiles and raceway have a .50 NRC rating. Standard panels with fabric tiles and a lifted base have a .55 NRC rating. Fabric tiles are fully tackable and available in monolithic, segmented, and stacking sections.
   (c) Solid Steel Tiles

(1) Steel tiles are constructed of 20-gauge formed steel with two rubber dampener pads adhered to the back of the tile to dampen sound. Two 1/16” x 1/4” x 1” magnets are adhered with double back tape to the back of the tile to aid in assembly without tools. Magnets are Neodymium (NdFeB), Grade N52 (4.45 lb. pull force) block with a nickel coating.

(d) Steel Markerboard Tiles

(1) Steel markerboard tiles are constructed of 22-gauge formed steel with honeycomb corrugated board adhered to the back of the tile to dampen sounds. Two 1/16” x 1/4” x 1” magnets are adhered with double back tape to the back of the tile to aid in assembly without tools. Magnets are Neodymium (NdFeB) Grade N52 (4.45 lb. pull force) block with a nickel coating. A magnetic tray, markers and eraser can be specified separately. Steel markerboard tiles are available in segmented and stacking sections.

(e) Slat Wall Tiles

(1) Slat wall tiles are constructed of powder-coated extruded aluminum on the lower 8” portion, which functions as a tool rail, with fabric tiles on the remaining upper portion of the segment. Tile includes integral mounting hardware. Slat wall tiles are available in segmented and stacking sections.

(f) Glass Tiles

(1) Glass tiles feature glazed glass inserts captured in an aluminum extrusion frame. Glass is 1/4” thick tempered. Glass tiles are available in segmented and stacking sections.

(g) Perforated Steel Tiles

(1) Perforated steel tiles are constructed of 20-gauge steel with 3/32” diameter holes on 5/32” staggered centers. Perforated tiles may not be hung back-to-back with any other tile. Perforated steel tiles are available in segmented and stacking sections.

d. Acoustic Septum Kits - UNRC size

1) Acoustic Septa are rigid 2” thick composite fiberglass sheets. When installed, the septum increases the NRC of the raceway fabric panel from .50 NRC to .70 NRC per ASTM C423. Septa fit inside and fill the interior of the metal frame without the use of tools. When rigid wireways are included at beltway, the septa must be cut in the field to allow space for the wireway.

(a) Acoustic Septa are 2” thick and are available in seven widths and five heights designed to fit into all standard frame sizes.

(b) Acoustic Septa are constructed of three cured fiberglass layers that are bonded together. The two outer layers are 3 lb. (pcf) x 3/4” thick fiberglass. The center core is 12 lb. (pcf) x 1/2” fiberglass.

(1) The fibrous glass wool (fiberglass) is manufactured using a minimum of 30% post-consumer recovered materials and a minimum of 5% post-industrial (pre-consumer) recovered materials. Fiberglass bats are subsequently cured using heat to compress the fiberglass into desired densities. The ingredients of the fiberglass are listed Fibrous Glass, Urea extended phenol-formaldehyde resin, Formaldehyde, & Non-Woven facings

e. Glass Divider Screens

1) Glass divider screens are constructed of 3/8” tempered glass mounted in two injection-molded plastic clamps. Glass divider available in clear and satin etch (one side). Three visible edges are polished with two corner radii. Aluminum split top caps trim each side of the glass. Glass dimensions: 12” above top cap (13” actual) by panel width.

f. Wall Track

1) Wall track allows for hanging of components onto an existing structural wall in the identical method as if the components were hung on other panels. Wall track is constructed of slotted 16-gauge steel with powder-coat finish.

g. Power & Data
   1) The US standard electrical system supplied shall be an 810 electrical system. Rigid wireway can be mounted to any panel frame. Power is available at the following heights:
      (a) Base Height Power - found in the 6” base raceway of the panel.
      (b) Worksurface (Beltway) Height Power - The powered tiles allow for installation of worksurface height receptacles. Two duplex receptacles can be mounted in a tile (one in a 24” tile). Receptacles are approximately 32” high.
   2) Power is supplied through one or two available means:
      (a) 6-2-2
         (1) (6) hot wires
         (2) (2) shared oversized neutral wires
         (3) (2) ground wires - 1 isolated ground and 1 building ground
      (b) 4-4-2
         (1) (4) hot wires
         (2) (4) independent neutral wires
         (3) (2) ground wires - 1 isolated ground and 1 building ground
   3) Rigid Wireways
      (a) Each powered panel requires the use of rigid wireways to pass power to receptacles. Wireways may be mounted at the base of panels or at beltway height. Wireways are specified by panel width. The wireway design allows for snap connection of one panel’s wireway to another panel’s wireway through the use of common panel jumpers. All panels 24” and wider accept electrical components.
      (b) There are four port locations on each end of every rigid wireway 30” and larger. 24” wireways feature two ports on one end only.
      (c) Wireways mount by screws to attached brackets on the underside of the lower frame for base power. For beltway power, rigid wireways attach with screws to brackets that are hooked into the vertical posts at each end.
   4) Base Infeeds
      (a) The electrical system permits power infeed at the base raceway of the panel. Base infeeds are constructed of a 6’ long, 1/2” liquid-tight flexible metal conduit containing ten wires with a receptacle type design allowing for quick installation and removal. Infeeds rotate to allow for left or right configuration.
   5) Top Infeeds (Data and/or Power)
      (a) Power and data may be brought into a panel through the use of a top infeed. Top infeed assembly consists of a 7’ or 10’ extruded aluminum data and/or power pole, top cap and ceiling trim. The interior of the power pole features a septum for power and data cable management. Flexible conduit containing ten wires to span the ceiling with a snap fit attachment for connection to the rigid wireway cable must be specified separately. Refer to the Planning Guide for additional tips for specifying top infeeds.
   6) Power Pass-Through
      (a) The electrical system provides a method of passing power from one powered panel through a non-powered panel to the powered rigid wireway of the next panel. The pass-through consists of a standard rigid wireway without receptacles. Panel-to-panel jumpers are required to connect adjacent wireways.
   7) Panel-to-Panel Jumpers
      (a) 12” and 16” panel-to-panel jumpers feature nylon mesh casing.

8) System Jumpers
   (a) Designed for for interconnection of Manufactured Wiring Systems (such as KI Genius Wall) to Office Furnishings (such as KI Unite). Two lengths are available for inline and 90° connections. Jumpers are constructed with steel corrugated sheathing and steel shielded connectors.
9) Vertical Jumpers
   (a) 30” vertical jumpers feature steel corrugated casing.
10) Receptacles
   (a) The receptacles for the modular electrical system feature injection molded components which snap fit into the rigid wireways of the panels. The rated capacity of the duplex receptacles is 15 or 20 amps in either 4-4-2 or 6-2-2 circuit configurations. Beltway receptacles come with bezel plate.
11) Bezels/Filler Plates
   (a) Bezels and filler plates are molded in nylon molded in a variety of colors.
12) Raceway Cable Trough
   (a) A formed 22-gauge black steel trough manages cables in raceway. The optional trough installs with a snap fit into raceway clips at each end of a panel without the use of tools.

h. Desks.
1) Worksurfaces feature balanced construction of 45-pound density particleboard core adhered on top and bottom to a 1/16” face sheet of high-pressure laminate and a 1/16” phenolic backer. Edges are evenly adhered to the worksurface. All worksurfaces are pre-drilled for support brackets and support legs. Worksurface widths of 60” or greater feature integrated steel reinforcement for added strength. Grommets shall be provided as indicated and as per manufacturer.
   (a) Rectangular Worksurfaces
      (1) The standard rectangular worksurface are available in widths of 6” increments from 24” - 96”, and in depths of 18”, 22”, 24” and 30”. Provide as indicated on the drawings. Rectangular conference ends shall be provided where indicated.
   (b) 90° Corner Worksurfaces
      (1) 90° symmetrical corner worksurfaces: provide 36”, 42”, and 48” widths, and in 18”, 20”, and 22” depths as indicated on the drawings.
   (c) Shaped Worksurfaces
      (1) Peninsula, Extended Corner (shoe), Extended Corner Reduction (shoe), Tapered, 120°, and 60° shaped surfaces are available in a variety of widths and depths. Grommet locations as per manufacturer shall be provided in accordance to the locations indicated on the drawings.
   (d) Transaction Countertops
      (1) Transaction countertops are available from 24” - 84” wide in 6" increments, with a countertop depth of 16”. Countertops are also available for 90° corners. Support brackets feature steel locking clips to prevent dislodgment. Provide optional brackets for use on a 32” high panel, appropriate for ADA applications. Countertops accommodate task lighting.
   (e) Underhead Worksurfaces
      (1) Surfaces are available to hang underhead U-Series storage units. A 15” deep surface sits flush with underhead unit, with 22”, 24”, and 30” depths as indicated or scheduled.
   (f) Worksurface Grommets
      (1) Worksurface grommets shall fit a 3” hole in most work surfaces. Provide aluminum injection-molded grommets with powder-coat finish in color selected by the Architect.
   (g) Worksurface Wire Manager

(1) Wire manager shall be constructed of black hook-and-loop ribbon, 7 1/2” long by 2” wide. The harness is fastened to the underside of the worksurface with pressure-sensitive adhesive. This wire manager supports cords and communication cables under the worksurface.

(h) Modesty Panel

(1) Modesty panel is constructed with a frameless 1/4” thick sheet of extruded acrylic in cloud or white color. Panels range from 24” to 72” wide in 6” increments. All panels are 10” high. The panel is fastened to a 14-gauge steel rail with a series of 14-gauge “L” shaped steel clips. The rail and clip feature a powder-coat finish available in colors to match the panel trim. Steel screws fasten the acrylic panel to the rail and underside of the worksurface. Colors shall be as selected by the Architect.

2) Worksurface Support

(a) Worksurface Support Legs

(1) Support legs provide both worksurface support and panel support in certain configurations. Brackets on the support leg prevent dislodgment from the vertical post of the panel. Worksurface support legs are determined by worksurface depth, width and configuration.

(b) Worksurface End Support Legs

(1) End support legs shall be provided at the ends of perpendicular and peninsula worksurfaces.

(c) Worksurface Support Brackets Types:

(1) Standard cantilever brackets.

(2) Design brackets.

(3) Type shall be as selected by the Architect.

(d) Worksurface Vertical Fillers

(1) 3” worksurface vertical filler spans the gap when one worksurface drops from the standard 29” down to an adjacent 26” worksurface. Provide Worksurface vertical fillers in 24” and 30” widths to match worksurface depths and are attached to worksurfaces with wood screws. Filler shall be constructed of 15-gauge powder-coated steel.

i. Tables:

1) Freestanding Table:

(a) Table Tops

(1) Table tops shall be balanced construction of 45-pound density particleboard core adhered on top and bottom to a 1/16” face sheet of high-pressure laminate and a 1/16” phenolic backer. Edges are evenly adhered to the worksurface. All worksurfaces are pre-drilled for support legs. Rectangular shapes are available in 24” and 30” depths and 48”, 60” and 72” lengths. Provide as indicated on the drawings.

(b) Welded Table Supports:

(1) Bottom, vertical and horizontal tubes - 14-gauge measuring 1 1/2” x 3/4”.

(2) Top mounting bracket - formed 14-gauge steel.

(3) Glide - 3/8”-16 x 1” diameter.

(4) Provide optional Leg insert - 18-gauge perforated steel.

j. Shelving/Storage:

1) U-Series Underhead Storage:

(a) Underhead dimensions and specifications shall match those of overhead units. Underhead may be mounted on any approved panel run (provided one end of the underhead is adjacent to a return). Underhead accommodates standard binders. Storage units include holes in top and bottom for cord drop in conjunction with grommets. Brackets for attachment shall be provided. Provide Legs where indicated.

2) Shelf Dividers:
   (a) Shelf dividers shall be compatible with Universal and Balance overheads, cabinets, and shelves. Shelf dividers are powder-coated steel, color as selected by the Architect.
3) Vertical Storage unit:
   (a) Vertical storage units are constructed of injection molded plastic. Units are suspended from tool rail or used freestanding on worksurfaces and shelves as indicated.
4) Diagonal Storage Unit
   (a) Diagonal storage units are constructed of injection molded plastic. Three ABS dividers may be used in left or right positions. Units are supported by the tool rail. Dimensions: 2 1/2” high by 7” wide by 12 1/2” deep.
5) Frameless Markerboards
   (a) Frameless steel markerboards are constructed of 22-gauge steel with an erasable white coating and a honeycomb backer to dampen sound. Markerboard surfaces are magnetic and include a 16” x 1 1/2” magnetic removable tray with markers and eraser. Markerboards mount in vertical post rail slots of a panel or wall track. Frameless markerboards mount on module only.
6) Framed Markerboards
   (a) Framed markerboards are constructed of white powder-coated aluminum frame with a white porcelain erasable surface. Markerboard surfaces are magnetic and include a 16” by 2 1/2” magnetic removable tray with markers and eraser. Markerboards mount in vertical post rail slots of a panel or wall track. Framed markerboards mount on module only.

k. Movable units and accessories:
1) Tool Rail:
   (a) Tool Rails shall be fabricated of a powder-coated aluminum extrusion. Tool rails are attached to the panel through the use of steel brackets. Available for standard panel sizes. Tool rails mount in vertical post rail slots of panel of wall track. Tool rails mount on module only.
2) Paper Tray Unit:
   (a) Legal and letter sized paper trays are constructed of injection molded plastic. Trays are supported by the tool rail. Dimensions: 2” high by 9 1/2” wide by 14” deep, 2 1/2” high by 7” wide by 12 1/2” deep, or 9” high by 5” wide by 10 1/2” deep.
3) Countertop Task Lights:
   (a) Task lights suspend from the underside of the countertop. Task lights are offered in standard panel trim colors as selected by the Architect. The task lights feature an 8’ cord which can be concealed by tucking between the reveal along tiles.
4) Overhead Cabinet Task Lights:
   (a) Task lights suspend from the shelf and overhead cabinet. Task light mounts on the underside of the shelf and overhead cabinet, and feature a 9’ cord. Cords can be concealed by tucking between the reveal along tiles.
5) Telephone Caddy:
   (a) Plastic caddies are adjustable to accommodate a phone up to 10 3/4” deep. Caddy includes three hooks for suspending from tool rail. Dimensions: 2” high by 8 1/2” wide by 9 1/2” deep.
6) Accessory Tray:
   (a) Plastic accessory trays include three hooks for mounting. Trays feature compartments to hold pencils, paper clips and miscellaneous items. Trays are suspended from tool rail or used freestanding on worksurfaces and shelves. Dimensions: 2” high by 9 1/2” wide by 10” deep.
7) Pencil Cup:

(a) Injection molded plastic cups provide for storage of pens, pencils and highlighters. One hook is provided for mounting on tool rail. Dimensions: 4" high by 4" wide by 3 1/2" deep.

l. Tack surfaces:

1) Tackboards shall be constructed of 3/4" wood fiber board covered with fabric. The mounting brackets are steel powder-coated and attached to the core with T-nuts and machine screws. Fabric is attached to the core with staples. Tackboards mount in the vertical post rail slots of a panel or wall track. Tackboards mount on module only.

B. FINISHES:

1. Standard KI fabrics available; C.O.M. (customer's own material) fabrics require factory approval. All finishes and colors shall be selected by architect. Refer to KI Color Addendum for standard finishes.

C. TEST REQUIREMENTS

1. All panels meet the flammability requirements as defined in the ANSI/UL 1286 safety standard for Office Furnishings. Class A rated standard finishes are available. The panel system, including the modular US electrical components, meets applicable UL standards and requirements as identified by Underwriters Laboratories, Inc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. 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 in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Test for proper operation and adjust until satisfactory results are obtained.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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 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.

1.03 RELATED REQUIREMENTS:

A. Section 015000 - Temporary Facilities and Controls: protection of openings and personnel barriers, temporary power and lighting.

B. Section 033000 - FIRE EXTINGUISHERS for setting sleeves, inserts, and anchoring devices in concrete.

C. Section 042200 - CONCRETE UNIT MASONRY 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 055000 - METAL FABRICATIONS for the following:
   1. Attachment plates and angle brackets for supporting guide-rail brackets.
   2. Divider beams.
   3. Hoist beams.
   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 09 for finish flooring in elevator cars.

H. Section 099123 - INTERIOR PAINTING for field painting of hoistway entrance doors and frames.

I. Section 221429 - SUMP PUMP for sump pumps, oil interceptors, sumps, and sump covers in elevator pits.

J. 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. Light outlet in the center of hoistway as indicated by the elevator contractor.
   6. Standby Power Supply Systems: emergency generator for elevator operations.
   7. Telephone Systems: ADAAG required emergency communications systems.
   8. Provision of telephone and convenience outlet on control panel.

K. Division 23: Heating, Ventilating and Air Conditioning:
   1. Heating and Ventilating of hoistways and Machine Rooms.

1.04 REGULATORY REQUIREMENTS

A. ADA Standards - Americans with Disabilities Act Accessibility Guidelines.

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. ICC A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.

1.05 SYSTEM DESCRIPTION

A. Application: Machine Room Less (MRL).

B. Machine Location: Top of the hoistway mounted on car and counterweight guide rails.

C. Control Space Location: Top landing entrance frame or entrance frame at one floor below the top landing.

D. Elevator Types and Performance Requirements:

1.	Quantity of Elevator:	One (1)
2.	Elevator Model:	Schindler 3300XL MRL Traction
3.	Operation System:	Microprocessor Single Car Automatic Operation
4.	Elevator Numbers:	Elevator No. No. 1
5.	Service:	Hospital Service
6.	Number of stops /opgs.	
	Elevator No. 1	Two (2) stops, Both front.
7.	Travel:	
	Elevator	15'-0"
8.	Rated Capacity:	
	All Elevators	4000 lb. capacity
9.	Speed:	
	All Elevators	150 fpm
10.	Cab Size:	
	All Elevators	5'-4 1/4" wide by 7'-8 1/2" deep
11.	Cab Heights:	All 7'-9" height nominal or as indicated.
12.	Hoistway Entrance Size:	All 4'-0" wide x 7'-0" high
13.	Door Type:	Two Speed Side-Slide
14.	Power Characteristics:	480V, 3 phase
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. Performance
   1. Car Speed: -10% to +5% of contract speed under any loading condition or direction of travel.
   2. Car Capacity: Safely lower, stop and hold up to 125% of rated load per code.

F. Ride Quality:

1.	Vertical Vibration (maximum):	25 mg
2.	Horizontal Vibration (maximum):	15 mg
3.	Vertical Jerk (maximum):	2 ft/sec^3
4.	Acceleration (maximum):	1.6 ft/sec^2
5.	In Car Noise:	53-60 dB(A)
6.	Stopping Accuracy:	±5mm
7.	Starts per hour (maximum):	180

G. Elevator Operation:
   1. 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.
   2. Group Automatic Operation with Demand-Based Dispatching: Provide reprogrammable group automatic system that assigns cars to hall calls based on a dispatching algorithm designed to minimize passenger waiting time.

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

1.06 ACTION SUBMITTALS

A. Comply with Section 013300 - SUBMITTALS.

B. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures, hoistway entrances, and operation, control, and signal systems.

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. Indicate electrical power requirements, 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. Warranty: Submit manufacturer/installer’s standard warranty.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. 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.

C. Sample Warranty: For special warranty.

1.08 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.

1.09 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.
   5. LEED Gold certified elevator manufacturing facility.

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, CAN4-S104 (ULC-S104), 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.

1.14 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.
   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.

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. Manufacturer: Subject to compliance with requirements, provide products by Schindler Elevator Corporation, PO Box 1935, Morristown, New Jersey 07962. Phone (973) 397-6500. Website www.us.schindler.com.
   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: 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.

C. Seismic Performance: Elevator system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and shall comply with elevator safety requirements for seismic risk Zone 1 or greater in ASME A17.1.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
   2. Affected peak velocity acceleration (Av) for Project's location is greater than or equal to 0.10, but less than 0.20.
   3. Provide earthquake equipment required by ASME A17.1.
   4. Provide seismic switch required by ASCE/SEI 7.

5. Elevator Component Importance Factor: 1.5.

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. The controller shall be distributed throughout the elevator system located in the overhead, cab and inspection and test panel. The inverter will be mounted in the overhead adjacent to the hoist machine and an inspection and test panel will be located in the door jamb at the top floor or one floor below the top floor. No elevator equipment mechanical rooms or closets are required.
   3. Provide multi-bus control architecture to reduce cabling, material and waste.

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. 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: Non circular Elastomeric coated suspension media with high tensile grade steel cords.

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: Rigid flush panel construction with reinforcement ribs.
   3. Frames: Securely fasten at corners to form unit frame. Frames shall be bolted.

B. Finish:
   1. Exposed Areas of Corridor Frames: Stainless Steel - All Floors
   2. Doors: Stainless Steel - All Floors
   3. Sills: 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. The safety shall be integral to the car frame and shall be flexible guide clamp type.

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. Design cab to comply with LEED Indoor Environmental Quality requirements through use of Low-Emitting Materials on walls, ceiling and subflooring.
   3. Car wall finish: #4 Brushed Stainless Steel.
   4. Base and frieze: Aluminum.
   5. Car front finish: #4 Brushed Stainless Steel.
   6. Car door finish: #4 Brushed Stainless Steel.
   7. Ceiling: Canopy ceiling, Down light type, Stainless Steel metal pans with suspended LED down lights.
   8. Handrail: Provide 1/2 inch x 2 inch Flat Bar 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.
   9. Flooring: By others. Not to exceed 3/8” finished depth.
   10. Ventilation: Provide one-speed fan in canopy.
   11. 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.
   12. Emergency Siren: Provide siren mounted on top of the car that is activated when the Alarm button in the car operating panel is engaged.
   13. 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.
   14. Emergency Exit Lock: Provide an emergency exit lock where required by local code.

15. Emergency Exit Guard: Provide emergency exit guard on top of car when required for hoistway wall to platform clearance exceeds 12” or for multiple cars in hoistway.

2.08 DOOR OPERATOR AND REOPENING DEVICES

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.

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.
   1. Full height car operating panel shall be surface-mounted on front return.
   2. Comply with handicap requirements.
   3. Push Buttons: Mechanical, illuminating using long-lasting LEDs for each floor served.
   4. 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. Firefighter’s hat and Phase 2 Key-switch
   6. Inspection key-switch.
   7. Key-switch for optional Independent Service Operation
   8. Illuminated alarm button with raised marking.
   9. Elevator Data Plate marked with elevator capacity and car number.
   10. 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.
   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. Hoistway access switches: Provide key-switch at top and/or bottom floor in entrance jamb as required by local code.

F. Firefighter's Phase 1 Service: Key switch in brushed stainless steel cover plate.

G. 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.

H. 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.

2.11 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

D. Stainless-Steel Sheet: ASTM A240/A240M, Type 304.

E. Stainless-Steel Bars: ASTM A276/A276M, Type 304.

F. Stainless-Steel Tubing: ASTM A554, Grade MT 304.

G. Aluminum Extrusions: ASTM B221, Alloy 6063.

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. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. Proceed with installation only after unsatisfactory conditions have been corrected.

D. 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. 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.

D. Lubricate operating parts of systems as recommended by manufacturers.

E. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.

F. Set sills flush with finished floor surface at landing. Fill space under sill solidly with non-shrink, nonmetallic grout.

G. 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 18 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

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Pipe hangers and supports

B. Anchors and attachments

C. Fasteners

D. Shop plating and painting

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Companion high density filler pieces for installation over the top 180 degree surface of pipe or tubing, at points of support where a combination clevis hanger, insulation shield and high density insulating saddle are installed.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Details of trapeze hangers and upper hanger attachments for piping 4 inches in diameter and over. Include the number and size of pipe lines to be supported on each type of trapeze hanger.

B. Product Data: Catalog sheets, specifications and installation instructions for each item specified except fasteners.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with the applicable requirements of the ASME B31 Piping Codes.
   2. Unless otherwise shown or specified, comply with the requirements of the Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58, and SP-69.
   3. Materials for use in Sprinkler Systems and Standpipe and Hose Systems shall comply with the requirements of NFPA 13 and NFPA 14 as applicable.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddle with companion high density filler piece.
   1. Insulating saddles and filler pieces shall be of the same thickness and materials as the adjoining pipe insulation. Saddles shall cover the lower 180 degrees of the pipe or tubing, and companion filler pieces shall cover the upper 180 degrees of the pipe or tubing. Physical sizes, gages, etc. of the components of insulated hangers shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAGE	SADDLE LENGTH (Inches)	VAPOR BARRIER JACKET LENGTH (Inches)
Up to 2-1/2	4	16	6	10
3 to 6	4	14	6	10

8 to 14	10	12	12	16
16 and up	10	10	12	16

B. Pipe Insulation Shields: Fabricated of steel, with a minimum arc of 180 degrees, unless otherwise indicated. Shields for use with hangers and supports, with the exception of combination clevis type hangers, shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAGE
Up to 2-1/2	8	18
3 to 8	10	16
10 to 14	12	12
16 and up	18	10

C. Pipe Hangers: Height adjustable standard duty clevis type, with cross bolt and nut.
   1. Pipe spreaders or spacers shall be used on cross bolts of clevis hangers, when supporting piping 10 inches in size and larger.
   2. Swivel ring type hangers will be allowed for sprinkler piping up to a maximum of 2 inches in size.

D. Adjustable Floor Rests and Base Flanges: Steel.

E. Hanger Rods: Mild, low carbon steel, fully threaded or threaded at each end, with two nuts at each end for positioning rod and hanger, and locking each in place.

F. Riser Clamps: Malleable iron or steel.

2.02 ANCHORS AND ATTACHMENTS

A. Sleeve Anchors (Group II, Type 3, Class 3): Molly's Div./USM Corp. Parasleeve Series, Ramset's Dynabolt Series, or Red Head/Phillips AN, HN, or FS Series.

B. Wedge Anchors (Zinc Plated, Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly's Div./USM Corp. Parabolt PB Series, Ramset's Trubolt T Series, or Red Head/Phillips WS Series.

C. Self-Drilling Anchors (Group III, Type 1): Ramset's RD Series, or Red Head/Phillips S Series.

D. Non-Drilling Anchors (Group VIII, Type 1): Ramset's Dynaset DS Series, Hilti's HDI Series, or Red Head/Phillips J Series.

E. Stud Anchors (Group VIII, Type 2): Red Head/Phillips JS Series.

F. Beam Clamps: Forged steel beam clamp, with weldless eye nut (right hand thread), steel tie rod, nuts, and washers, Grinnell's Fig No. 292 (size for load, beam flange width, and rod size required).

G. Metal Deck Ceiling Bolts: B-Line Systems' Fig. B3019.

2.03 FASTENERS

A. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for high humidity locations, and treated wood; plain finish for other interior locations. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work.

2.04 SHOP PAINTING AND PLATING

A. Hangers, supports, rods, inserts and accessories used for pipe supports, unless chromium plated, cadmium plated or galvanized shall be shop coated with metal primer paint.

PART 3 EXECUTION

3.01 INSTALLATION

A. Do not hang or support one pipe from another or from ductwork.
   1. Do not bend threaded rod.

B. Support all insulated horizontal piping conveying fluids below ambient temperature, by means of hangers or supports with insulation shields installed outside of the insulation.

C. Space hangers or supports for horizontal piping on maximum center distances as listed in the following hanger schedules, except as otherwise specified, or noted on the Drawings.
   1. For Steel Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1 and under	8
1-1/4 and 1-1/2	9
2	10
2-1/2 and up	12

   1. For Grooved End Steel Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1-1/2 and under	7
2 through 4	10
5 and over	12

   1. No pipe length shall be left unsupported between any two coupling joints.
   2. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
   3. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
   4. For Branch Piping Runs and Runouts Over 5 feet In Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
   5. Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the

entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.

D. Minimum Hanger Rod Size: Increase hanger rod size as required to meet requirements of seismic restraint system.

PIPE OR TUBING SIZE (Inches)	SINGLE ROD HANGER SIZE (Inches)		DOUBLE ROD HANGER SIZE (Inches)	
	PIPE	TUBING	PIPE	TUBING
1/2 to 2	3/8	1/4	3/8	1/4
2-1/2 and 3	1/2	3/8	3/8	1/4
4 and 5	5/8	1/2	1/2	3/8
6	3/4	1/2	5/8	1/2
8, 10 and 12	7/8	5/8	3/4	5/8

1. Size hanger rods, for piping over 12 inches in size and multiple line supports, based on a safety factor of five for the ultimate strength of the materials being used.
2. Secure hanger rods as follows: Install one nut under clevis, angle or steel member; one nut on top of clevis, angle or steel member; one nut inside insert or on top of upper hanger attachment and one nut and washer against insert or on lower side of upper hanger attachment. A total of four nuts are required for each rod, two at upper hanger attachment and two at hanger.

E. Vertical Piping:
1. Support vertical risers of piping systems, by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs. Provide adequate clearances for risers that are subject to appreciable expansion and contraction, caused by operating temperature ranges.
2. Support extension arms of riser clamps, secured to risers to be insulated for cold service, 4 inches above floor slabs, to allow room for insulating and vapor sealing around riser clamps.

F. Floor Supports: Install adjustable yoke rests with base flanges, for the support of piping, unless otherwise indicated on the Drawings. Install supports in a manner, which will not be detrimental to the building structure.

3.02 UPPER HANGER ATTACHMENTS

A. General:
1. Secure upper hanger attachments to overhead structural steel, steel bar joists, or other suitable structural members.
2. Do not attach hangers to steel decks that are not to receive concrete fill.
3. Do not attach hangers to precast concrete plank decks less than 2-3/4 inches thick.
4. Do not use flat bars or bent rods as upper hanger attachments.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by pipe support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of five.
   1. Do not use drive-on beam clamps.
   2. Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.
   3. Do not drill holes in main structural steel members.
   4. Beam clamps, with tie rods as specified, may be used as upper hanger attachments for the support of piping, subject to clamp manufacturer's recommended limits.

C. Attachment to Concrete Filled Steel Decks:
   1. New Construction: Install metal deck ceiling bolts.
   2. Existing Construction: Install welding studs (except at roof decks). Do not support a load in excess of 250 lbs from any single welded stud.
   3. Do not attach hangers to decks less than 2-1/2 inches thick.

D. Attachment to Cast-In-Place Concrete: Secure to overhead construction by means of cast-in-place concrete inserts.

E. Attachment to Existing Cast-In-Place Concrete:
   1. For piping up to a maximum of 4 inches in size, secure hangers to overhead construction with self-drilling type expansion shields and machine bolts.
   2. Secure hangers to wall or floor construction with single unit expansion shields or self-drilling type expansion shields and machine bolts.

F. Attachment to Cored Precast Concrete Decks (Flexicore, Dox Plank, Spancrete, etc.): Toggle bolts may be installed in cells for the support of piping up to a maximum of 2-1/2 inches in size.

G. Attachment to Hollow Block or Hollow Tile Filled Concrete Decks:
   1. New Construction: Omit block or tile and pour solid concrete with cast-in-place inserts.
   2. Existing Construction: Break out block or tile to access, and install machine bolt anchors at highest practical point on side of web.

H. Attachment to Waffle Type Concrete Decks:
   1. New Construction: Install cast-in-place inserts.
   2. Existing Construction: Install machine bolt expansion anchors at highest practical point on side of web.

I. Attachment to Precast Concrete Tee Construction:
   1. New Construction: Tee hanger inserts between adjacent flanges, except at roof deck without concrete fill.
   2. Existing Construction: Dual unit expansion shields in webs of tees. Install shields as high as possible in the webs.
      a. Exercise extreme care in the field drilling of holes to avoid damage to reinforcing.
      b. Do not use powder driven fasteners.

J. Attachment to Wood Construction: Secure hangers to the sides (only) of wood members, by means of malleable iron side beam connectors, or malleable iron or steel side beam brackets. Do not secure hanger attachments to nailing strips resting on top of steel beams.
   1. Secure side beam connectors to wood members with two No. 18 x 1-1/2 inch long wood screws, or two No. 16 x 1-1/2 inch long drive screws. Do not support piping over 1-1/2 inches in size from side beam connectors. Do not hammer in wood screws.
   2. Secure side beam brackets to wood members with steel bolts or lag screws. Do not use lag screws in wooden members having a nominal thickness (beam face) less than 2

inches in size. Install bolts or lag screws, in the sides of a timber or a joist, at the mid-point or above, not less than 2-1/2 inches from the lower edge when supporting branch lines and not less than 3 inches from the lower edge when supporting mains. Install heavy gage steel washers under all nuts.

3. Secure side beam brackets to wooden beams or joists, with lag screws or bolts of size as follows:

PIPE SIZE (Inches)	LAG SCREW SIZE (Inches)	BOLT DIAMETER (Inches)
2 and under	3/8 diameter x 1-3/4	3/8
2-1/2 and 3	1/2 diameter x 2	1/2
4 and 5	Use Bolt	5/8

1. Do not support piping larger than 3 inches with lag screws. Pre-drill holes for lag screws 1/8 inch in diameter less than the root diameter of the lag screw thread.
2. The minimum width of the lower face of wood beams or joints in which lag screws of size as specified may be used is as follows:

LAG SCREW DIAMETER (Inches)	NOMINAL WIDTH OF BEAM FACE (Inches)
3/8	2
1/2	3

1. Do not secure hanger attachment to the diagonals or vertical members of the trusses.

3.03 PIPING IN TUNNELS

A. Support piping in tunnels on adjustable stanchions, fabricated in accordance with the details on the Drawings, unless otherwise indicated. Install, secure and be responsible for the proper locations of all cast-in-place inserts and stanchion supports, in ample time so as not to delay construction Work. Secure tops of stanchions to overhead construction, as required and approved.

3.04 COMBINATION CLEVIS HANGER, PIPE INSULATION SHIELD AND VAPOR BARRIER JACKETED HIGH DENSITY INSULATING SADDLES

A. Install a combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddles, at all points of support for piping or tubing to be insulated for cold service. Furnish companion high density vapor barrier jacketed saddle pieces, of the same material, thickness and length, for installation over the top 180 degree surface of pipe or tubing, at each point of support where an insulated clevis hanger is utilized.

3.05 PIPE INSULATION SHIELDS

A. Unless otherwise specified, install a pipe insulation shield, at all points of support. Center shields on all hangers and supports outside of high density insulation insert, and install in such a manner so as not to cut, or puncture jacket.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Piping insulation

B. Insulation jackets

C. Adhesives, mastics, and sealers

D. Miscellaneous materials

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Through Penetration Firestops: Section 078400.

B. Painting: Section 099103.

C. Pipe Hangers and Supports: Section 210529.

1.03 ABBREVIATIONS

A. FS: Federal Specification.

B. K: Thermal Conductivity, i.e., maximum Btu per inch thickness per hour per square foot.

C. pcf: Pounds per cubic foot.

D. PVC: Polyvinylchloride.

1.04 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications and installation instructions for the following:
   1. Insulation Materials.
   2. Jacket Materials.

B. Quality Control Submittals:
   1. Installers Qualification Data:
      a. Name of each person who will be performing the Work, and their employer's name, business address and telephone number.
      b. Furnish names and addresses of the required number of similar projects that each person has worked on which meet the qualifications.

1.05 QUALITY ASSURANCE

A. Qualifications: The persons installing the Work of this Section and their Supervisor shall be personally experienced in mechanical insulation work and shall have been regularly employed by a company installing mechanical insulation for a minimum of 5 years.

B. Regulatory Requirements:
   1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

PART 2 PRODUCTS

2.01 PIPING INSULATION

A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.
   1. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM C 547:
      a. Class 1 (Suitable for Temperatures Up to 450 degrees F): K of 0.26 at 75 degrees F.
   2. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees F; ASTM C 547, Class 1.
   3. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.
      a. Suitable for temperatures up to 450 degrees F.

B. Flexible Elastomeric Foam Insulation:
   1. FM tested and approved, meeting the following:
      a. Maximum Water Vapor Transmission: 0.10 perm - inch based on ASTM E 96, Procedure A.
      b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.
      c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.
   2. Pipe Insulation: ASTM C 534, Type I.
   3. Polyethylene and polyolefin insulation is not acceptable.

C. High Density Jacketed Insulation Inserts for Hangers and Supports:
   1. For Use with Fibrous Glass Insulation:
      a. Cold Service Piping:
         1) Polyurethane Foam: Minimum density 4 pcf, K of 0.13 at 75 degrees F, minimum compressive strength of 125 psi.
   2. For Use with Flexible Elastomeric Foam Insulation: Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as specified or required.

D. Cements:
   1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.
   2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.02 INSULATION JACKETS

A. Laminated Vapor Barrier Jackets for Piping: Factory applied by insulation manufacturer, conforming to ASTM C 1136, Type I.
   1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.
      a. Pipe Jackets: Furnished with integral 1-1/2 inch self sealing longitudinal lap, and separate 3 inch wide adhesive backed butt strips.
   2. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.

B. Canvas Jackets: Cotton duck, fire retardant, complying with NFPA 701, 4 oz or 6 oz per sq yd as specified.

C. Premolded PVC Fitting Jackets:
   1. Constructed of high impact, UV resistant PVC.
      a. ASTM D 1784, Class 14253-C.
      b. Working Temperature: 0-150 degrees F.

2.03 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childers' CP-50A, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

C. Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

E. Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.

F. Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.

2.04 MISCELLANEOUS MATERIALS

A. Pressure Sensitive Tape for Sealing Laminated Jackets:
   1. Acceptable Manufacturers: Alpha Associates, Childers, Ideal Tape, Morgan Adhesive.
   2. Type: Same construction as jacket.

B. Wire, Bands, and Wire Mesh:
   1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel, gage as specified.
   2. Bands: Galvanized steel, 1/2 inch wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.
   3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

C. Reinforcing Membrane: Glass or Polyester, 10 x 10 mesh. Alpha Associates Style 59, Childer's Chil-Glas, Foster's MAST-A-FAB.

PART 3 EXECUTION

3.01 PREPARATION

A. Perform the following before starting insulation Work:
   1. Install hangers, supports and appurtenances in their permanent locations.
   2. Complete testing of piping.
   3. Clean and dry surfaces to be insulated.

3.02 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions unless otherwise specified.

B. Provide continuous piping insulation and jacketing when passing thru interior wall, floor, and ceiling construction.
   1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See 078400.
      a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.

C. Do not intermix different insulation materials on individual runs of piping.

3.03 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced while installing insulation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated piping.

C. Insulation Inserts For Use with Fibrous Glass Insulation:
   1. Where clevis hangers are used, install insulation shields and high density jacketed insulation inserts between shield and pipe.
      a. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, trapezes, etc.; fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.
         1) Exception: Locations where pipe covering protection saddles are specified for hot service piping, 6 inch and larger.

D. Insulation Inserts For Use with Flexible Elastomeric Foam Insulation:
   1. Where clevis hangers are used, install insulation shields with hardwood filler pieces, same thickness as adjoining insulation, inserted in undersized die cut or slotted holes in insulation at support points.
   2. Contour hardwood blocks to match the curvature of pipe, and shield.
   3. Coat dowels and blocks with insulation adhesive, and insert while still wet.
   4. Vapor seal outer surfaces of dowels and blocks with adhesive after insertion.
   5. Install filler pieces as follows:

PIPE/TUBING SIZE	FILLER PIECES	POSITION
Thru 1-1/2”	2 dowel plugs	6 o’clock; in tandem
2” thru 4”	1 block, 2 dowel plugs	6 o’clock, and 4 & 8 o’clock respectively
6” thru 8”	2 blocks, 4 dowel plugs	6 o’clock; in tandem and 4 & 8 o’clock; in tandem

3.04 INSTALLATION OF FIBROUS GLASS COLD SERVICE INSULATION

A. Install insulation materials with a field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket, unless otherwise specified.

B. Piping:
   1. Butt insulation joints together, continuously seal minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips.
      a. Substitution: 3 inch wide pressure sensitive sealing tape, of same material as jacket, may be used in lieu of butt strips.
   2. Bed insulation in a 2-inch wide band of vapor barrier mastic, and vapor seal exposed ends of insulation with vapor barrier mastic at each butt joint between pipe insulation and equipment, fittings or flanges at the following intervals:
      a. Horizontal Pipe Runs: 21 ft.
      b. Vertical Pipe Runs: 9 ft.

C. Fittings, Valves, Flanges and Irregular Surfaces:
   1. Insulate with mitre cut or premolded fitting insulation of same material and thickness as pipe insulation.
   2. Secure insulation in place with 16-gage wire, with ends twisted and turned down into insulation.

3. Butt insulation against pipe insulation and bond with joint sealer.
4. Insulate valves up to and including bonnets, without interfering with packing nuts.
5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.
6. When insulating cement has dried, seal fitting, valve and flange insulation, by imbedding a layer of reinforcing membrane or 4 oz. canvas jacket between 2 flood coats of vapor barrier mastic, each 1/8 inch thick wet.
7. Lap reinforcing membrane or canvas on itself and adjoining pipe insulation at least 2 inches.
8. Trowel, brush or rubber glove outside coat over entire insulated surface.
9. Exceptions:
    a. Type D Piping Systems: Valves, fittings and flanges may be insulated with premolded PVC fitting jackets, with fibrous glass insulation inserts.
        1) Additional insulation inserts are required for services with operating temperatures under 45 degrees F or where insulation thickness exceeds 1-1/2 inches. The surface temperature of PVC fitting jacket must not go below 45 degrees F.

3.05 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Where possible, slip insulation over the pipe, and seal butt joints with adhesive.
    1. Where the slip-on technique is not possible, slit the insulation and install.
    2. Re-seal with adhesive, making sure the mating surfaces are completely joined.

B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer, and assemble the cut sections in accordance with the manufacturer's printed instructions.
    1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation with adhesive.

C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier of the system.

D. Piping Exposed Exterior to a Building, Totally Exposed to the Elements:
    1. Apply flexible elastomeric foam insulation to piping with adhesive.
    2. Apply reinforcing membrane around piping insulation with adhesive or mastic.
    3. Adhesive Applied System: Apply 2 coats of finish. See Section 099103.
    4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.06 FIELD QUALITY CONTROL

A. Field Samples: The Director's Representative, may at their discretion, take field samples of installed insulation for the purpose of checking materials and application. Reinsulate sample cut areas.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Valves and accessories
   1. Gate valves
   2. Inspector's test outlet valve
   3. Valve locking devices
   4. Alarm check valve
   5. Check valves
   6. Pressure gages
   7. Inspector's test connection

B. Sprinkler heads and appurtenances

C. Fire department connection

D. Water flow alarm device

E. Electrical alarm gong

F. Valve supervisory switches

G. Signs

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting: Section 099103.

B. Backflow Preventers: Section 210524.

C. Hangers and Supports: Section 210529.

D. Sprinkler Piping: Section 211300.

E. Motors and Motor Controllers: Section 260221.

1.03 REFERENCES

A. NFPA 13 - National Fire Protection Association Standard for the Installation of Sprinkler Systems.

1.04 SYSTEM DESCRIPTION

A. Type of System:
   1. Wet System

1.05 SUBMITTALS

A. Shop Drawings:
   1. Complete sprinkler system layout indicating the locations of sprinkler heads, devices, and accessories. Include separate details of special or not easily visualized piping arrangements and inspector’s test valves and connections.
   2. Hydraulic calculations shall be complete and cross referenced to the appropriate drawing sheets.

B. Product Data: Catalog sheets, specifications, and installation instructions. Indicate UL or FM approval for each product. Include the following additional information:
   1. Electrical Devices: Complete description of intended use, wiring diagrams, data plate information and, in the case of switching devices, whether normally on, or normally off. Include motor test data.
   2. Mechanical Devices: Complete description of intended use, including normal operating capacities and working pressures.
   3. Enclosures: Dimensions, materials, gages of metals; type of door hinges and locks, and methods of securing the enclosure members to the building construction.
   4. Hose Threads: Verify that hose threads on fire department connections match threads on equipment used by the local or servicing fire department.

C. Quality Control Submittals:
   1. Design Data: The portions of the sprinkler system not sized on the Contract Drawings shall be sized in accordance with NFPA requirements for Hydraulically Designed Systems. Submit drawings and hydraulic calculations for approval.
   2. Certificates: As required under Quality Assurance Article.
   3. Installers Qualification Data:
      a. Name of each person who will be performing the Work.
      b. Upon request, furnish names and addresses of the required number of similar projects that each person has worked on which meet the experience criteria.

D. Contract Closeout Submittals:
   1. Operation and Maintenance Data. Deliver 2 copies to the Director's Representative:
      a. Instruction manual describing the operation and maintenance of the system.
      b. Parts list for each mechanical and electrical device.
      c. Publication NFPA 25, Inspection, Testing, and Maintenance of Water Based Fire Protection Systems.

1.06 QUALITY ASSURANCE

A. Qualifications: The persons employed to perform the Work of this Section and their supervisor shall be personally experienced in sprinkler work and shall have been regularly performing such work for a minimum of 5 years while in the employ of a company or companies engaged in the installation of sprinkler systems.
   1. Upon request, furnish to the Director the names and addresses of five similar projects which the foregoing people have worked on during the past 3 years.

B. Regulatory Requirements:
   1. Materials for the Work of this Section shall be Underwriter's Laboratories listed, and/or Factory Mutual approved.

C. Certification: NFPA Contractor's Material and Test Certificate.

1.07 MAINTENANCE

A. Spare Parts: Furnish the following items and deliver to the Owner for storage in spare sprinkler head cabinets:
   1. Spare sprinkler heads of each temperature range:
   2. One sprinkler head wrench to fit each type sprinkler head.

PART 2 PRODUCTS

2.01 VALVES AND ACCESSORIES

A. Gate Valves (175 psig non-shock working pressure):
   1. 3/4 inch to 2 inch: Bronze body, OS & Y indicating type; double or wedge disc with threaded ends.
   2. 2-1/2 inch and larger: IBBM, OS & Y indicating type; double or wedge disc with end connections as required to suit the piping system.

B. Inspector's Test Outlet Valve: Ball type, bronze body, Type 316 stainless steel ball and stem, teflon seats and stem packing, 400 psi WOG. Valve shall have padlocking feature in both the open and closed position.

C. Valve Locking Devices:
   1. Chain: 3/16 inch galvanized steel, welded link.
   2. Padlock: Series 800 by Yale, Eaton Corp., Charlotte, NC: Key all locks alike. Furnish 2 keys for each lock.
   3. Key Tags: 1-1/2 inch dia., brass, stamped with valve number and service.
   4. "S" Hooks: Brass, for securing keys to key tags.

D. Alarm Check Valve:
   1. Two piece cast iron body, bolted and gasketed.
   2. Moving parts brass, bronze, or stainless steel with replaceable rubber clapper facing.
   3. Right or left hand trimming as required.
   4. Suitable for horizontal or vertical installation.
   5. Two pressure gages.
   6. Main drain tap.
   7. Factory finish with corrosion resistant red paint.
   8. Trim Package: Angle valve, globe valve, alarm line strainer, orifice restriction, pipe nipples and fittings.

E. Check Valves: IBBM, single clapper swing check with metal to metal or rubber faced checks, suitable for horizontal and vertical installation; end connections as required to suit the piping system; 175 psig non-shock working pressure.
   1. Ball Drip (where shown on Drawings): Brass, automatic; threaded on both ends.

F. Pressure Gages: Range of 2 times system working pressure at point where installed. Equip with gage cock and provisions for draining.

G. Inspector's Test Connection: Cast brass, capped, sprinkler line tester fitting; Elkhart Brass Mfg. Co.'s. No. 112, or Seco Mfg., Inc.'s No. 445 or 446.

2.02 SPRINKLER HEADS AND APPURTENANCES

A. Sprinkler Heads: Brass or bronze, with standard 1/2 inch orifice, and deflector:
   1. Upright or Pendent Type: Deflector designed to distribute water downward in a uniform hemispherical spray pattern.
   2. Dry Pendent Type: Designed to prevent water and condensation from being trapped below the drainable system piping.
   3. Flush Pendent Type: All or part of sprinkler body including shank thread mounts above lower plane of finished ceiling.
   4. Sidewall Type: Horizontal or vertical sprinklers with special deflectors designed to discharge most of the water away from nearby wall in a pattern resembling 1/4 of a sphere with a small portion of discharge directed at wall behind sprinkler.

5. Markings: Stamp sprinkler type on deflector in addition to NFPA's color code requirements covering temperature classification.

B. Spare Sprinkler Head Cabinet: Steel, with hinged cover, constructed of minimum 20 gage material and fitted with 16 gage steel racks designed to hold quantities and types of spare sprinkler heads and sprinkler head wrenches.
   1. Finish: Bright red, baked on enamel.

2.03 FIRE DEPARTMENT CONNECTION

A. Siamese Connection: Two way flush wall type, brass with polished finish; size 2-1/2 x 2-1/2 x 4 inch , with two 2-1/2 inch female connections, 2 individual drop clapper valves, plugs and chains, and escutcheon.
   1. Equip above with integral sillcock having hose bibb end, cap, chain and removable tee handle key. Furnish 2 keys. Deliver to the Owner.

B. Identification: Provide signage stating "AUTOSPKR", or "AUTOSPKR AND STANDPIPE" or as required by AHJ.

2.04 WATER FLOW ALARM DEVICE

A. Vane Type Waterflow Switch: System Sensor WFDN, Autocall Div., Federal Signal Corp.'s 4160, Potter Electric Signal Co.'s VSR-F, or Reliable's Model A., having:
   1. Corrosion-resistant vane.
   2. Splash/dust resistant enclosure with anti-tamper switch.
   3. Adjustable pneumatic retard.
   4. Screw type wiring terminals.

2.05 ELECTRIC ALARM GONG

A. 8 inch diameter vibrating bell; 24 V dc. Sound rating 80 db; System Sensor SSM24-8 or equal.
   1. Markings: The words FIRE ALARM in block lettering on a contrasting background.
   2. Mounting: Suitable for both wall and ceiling mounting.

2.06 VALVE SUPERVISORY SWITCHES

A. Mechanically actuated, designed to close contacts and sound an alarm when supervised valve is closed and when switch cover removed.
   1. For Gate Valves: System Sensor OSY2, Potter Electric Signal Co.'s OSYSU-A, or Grinnell's F640.
   2. For Post Indicator Valves: Potter Electric Signal Co.'s PIVSU-A2, or Potter-Roemer, Inc.'s 6223.

2.07 SIGNS

A. Steel with vitreous enamel finish, lettering on contrasting background to identify and indicate the function of:
   1. Control valves.
   2. Drain, test, air supply and alarm check valves.
   3. Water motor alarm.
   4. Anti-freeze loop.
   5. Anti-freeze loop drain and test valves.
   6. Hydraulic Design Nameplate Data: Size approx. 9 x 12 inches, inscribed with the following::
      a. SPRINKLER SYSTEM HYDRAULICALLY DESIGNED (in block letters).
      b. Location and area of hydraulically designed section.

c. Discharge density over designed area in gallons per minute.
d. Residual pressure at base of riser supplying water to designed section.

PART 3 EXECUTION

3.01 INSTALLATION

A. Unless otherwise shown or specified, install the Work of this section in accordance with NFPA 13, and the item manufacturer's installation instructions.

B. Locking Valves:
1. Lock gate valves in open position with chain looped through handwheel and around adjacent sprinkler pipe. Secure with padlock.
2. Lock test outlet valve in closed position with padlock.

C. Spare Sprinkler Head Cabinet: Secure to building wall or other permanent structure in vicinity of main valve controlling sprinkler system, unless otherwise directed.

D. Signs: Install signs identifying the following:
1. Valves: One for each size, type and function.
2. Fire Department Connection
3. Alarm Valves
4. Hydraulically Designed System.

3.02 FIELD QUALITY CONTROL

A. Tests: Unless otherwise shown or specified, perform tests in accordance with NFPA 13.
1. Flushing: In addition to the requirements of the Standard, flush new piping before making final connection to existing systems and before performing hydrostatic test. Flush at rates of flow prescribed in the Contractor's Material and Test Certificate. After making final connections, flush entire system and assure that debris is removed from piping and there are no stoppages or obstructions in the system.
2. System Tests:
a. Test all new Work.
b. Notify the Director's Representative when the Work of this Section is ready for testing.
c. Perform the tests when directed, and in the Director's Representatives presence.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Gate valves

B. Globe and angle valves

C. Check valves

D. Butterfly valves

E. Safety and relief valves

F. Needle stop valves

G. Gage cocks

H. Ball valves

1.02 ABBREVIATIONS

A. IBBM: Iron body, bronze mounted.

B. OS&Y: Outside screw and yoke.

C. WOG: Water, oil, gas.

D. WSP: Working steam pressure.

1.03 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets and specifications for each valve type.

B. Valve Schedule: List type of valve, manufacturer's model number, and size for each service application.

1.04 MAINTENANCE

A. Special Tools:
   1. One wrench for each type and size wrench operated plug valve.

PART 2 PRODUCTS

2.01 VALVES - GENERAL

A. Valve Standardization: Valves from one or more manufacturers may be used, however valves supplied for each specific valve type shall be the product of one manufacturer.

B. Valves shall be first quality, free from all imperfections and defects, with body markings indicating manufacturer and rating.

C. Valve parts of same manufacturer, size and type shall be interchangeable.

D. Manually operated gate, globe and angle valves shall be of rising stem type, unless otherwise specified.

E. Valves which use packing, shall be capable of being packed when wide open and under full working pressure.

F. Size valves the same size as the piping in which they are installed, unless specified otherwise.

2.02 GATE VALVES

A. Type A: 125 psig WSP, 200 psig WOG, bronze body, union bonnet, solid wedge disc, and threaded ends. Acceptable Valves: Crane428UB, Hammond IB617, Jenkins 47CU, Milwaukee 1152, Nibco T13, and Stockham B105.

B. Type C: 125 psig WSP, 200 psig WOG up to 12 inch size, and 150 psig WOG for 14 inch and 16 inch sizes; IBBM OS&Y, bolted bonnet, solid wedge disc, and threaded or flanged ends depending on size. Acceptable Valves: Crane 464-1/2, 465-1/2, Hammond IR1140, Milwaukee F2885, Nibco T6170 & F6170, and Stockham G620 & G623

C. Type D: 125 psig WSP, 200 psig WOG, bronze body, threaded bonnet, solid wedge disc, and solder ends. Acceptable Valves: Crane 1330, Hammond IB635, Jenkins 991AJ, Milwaukee 149, Nibco S111, and Stockham B108.

2.03 GLOBE AND ANGLE VALVES

A. Type J: 125 WSP, 200 psig WOG, bronze body, threaded bonnet, and threaded ends. Acceptable Valves: Crane 1, Hammond IB440 & IB463, Jenkins 101J, Milwaukee 502, Nibco T211 & T311, and Stockham B16.

B. Type K: 125 psig WSP, 200 psig WOG, IBBM OS&Y, bolted bonnet, and threaded or flanged ends depending on size. Acceptable Valves: Crane 351 353, Hammond IR116, Jenkins 613C & 615C, Milwaukee F2981, Nibco F718B & F818B, and Stockham G512, & G515.

C. Type O: 125 psig, 200 psig WOG, bronze body, threaded bonnet, and solder ends. Acceptable Valves: Crane 1310, Hammond IB423, Jenkins 1200C, Milwaukee 1502, Nibco S21, and Stockham B17.

2.04 CHECK VALVES

A. Type S: 125 psig WSP, 200 psig WOG, bronze body, brass or bronze trim, horizontal swing, renewable and regrindable disc, and threaded ends. Face discs for cold water service with teflon. Acceptable Valves: Crane 37, Hammond IB940, Jenkins 4092, Milwaukee 509, Nibco T413Y, and Stockham B319Y.

B. Type U: 125 psig WSP, 200 psig WOG, bronze body, brass or bronze trim, horizontal swing, renewable and regrindable disc, and solder ends. Face discs for cold water service with teflon. Acceptable Valves: Crane 1340, Hammond IB912, Jenkins 4093, Milwaukee 1509, Nibco S413Y, and Stockham 309Y.

C. Type V: 125 psig WSP, 200 psig WOG, IBBM, horizontal swing, bolted bonnet, regrindable and renewable seat ring and disc, and threaded or flanged ends depending on size. Discs on valves 4 inch size and larger may be cast iron with bronze face. Acceptable Valves: Crane 372, & 373, Hammond IR1124, Jenkins 623CJ & 624CJ, Milwaukee F2974, Nibco F918, and Stockham G927 & G931.

D. Type W:
   1. Globe Style Silent Check Valve: IBBM or semi-steel with bronze mounting, renewable seat and disc, 18-8 stainless steel spring, and flanged ends.

a. Acceptable Valves (125 psig flange pressure rating): Apco Series 600, Combination Pump & Valve 20D, Hammond IR9354, Milwaukee 1800, Nibco F910, and Williams Hager 636.
b. Acceptable Valves (250 psig flange pressure rating): Apco Series 600, Combination Pump & Valve 21D, Milwaukee 1800, Nibco F960, and Williams Hager 636.

2. Wafer Style Silent Check Valve: IBBM or semi-steel with bronze mounting, renewable seat and disc, 18-8 stainless steel spring, and flanged ends.
a. Acceptable Valves (125 psig flange pressure rating): Apco Series 300, Combination Pump and Valve 10D, Hammond IR9253, Milwaukee 1400, Nibco W910, and Williams Hager 329 & 375.
b. Acceptable Valves (250 psig flange pressure rating): Apco Series 300, Combination Pump and Valve 11D, Milwaukee 1400, Nibco W960, and Williams Hager 329 & 375.

2.05 BUTTERFLY VALVES

A. Type BF: Iron body, flangeless wafer or lugged type, (lug for each bolt hole, drilled and tapped for cap screws), with replaceable reinforced resilient EPT (EPDM) seats, bronze or nickel plated ductile iron discs, phosphate coated steel or stainless steel stems, and raised necks able to accommodate 2 inches of insulation. Acceptable Manufacturers: Crane, Demco, De Zurik, Hammond, Keystone, Milwaukee, Nibco, Stockham, and Watts.
1. Pressure Ratings:
a. 12 inch size and Less: 200 psig WOG at 275 degrees F.
b. 14 inch size and Up: 150 psig WOG at 275 degrees F.

B. Operators:
1. 6 inch size and Less: Manual actuator handles with external indication of disc position, and suitable means of locking actuator in any fixed position.
2. 8 inch size and Up: Worm gear operator.

2.06 SAFETY AND RELIEF VALVES

A. General Requirements: Valves shall be as specified by ASME Code governing manufacture of such valves within scope of their particular usage, i.e., Heating Boilers, Unfired Pressure Valves, etc., shall be tested, rated and listed, unless otherwise specified. Valves for applications specified shall conform to the ASME Code, Section IV, Heating Boilers and the following:
1. Valves for combination domestic hot water heater and storage tanks shall conform to the requirements of ASME Code, Section IV and USA Standard Z21.22 and shall be NBB listed. Valves shall be of the temperature - pressure type. Thermostatic element shall, on rising temperature, cause the valve to open at 200 degrees F. and valve shall deliver its rated capacity at 210 degrees F. and close drip tight at 195 degrees F. Valves shall be sized in accordance with Unfired Vessel Code.
2. End Connections: Unless otherwise specified, safety valves, relief valves and safety relief valves, in sizes 3/4 inch to 3 inches IPS inclusive, may be furnished with male or female pipe thread inlet and female pipe thread outlet; valves over 3 inches IPS must be furnished with 125 lb. or 250 lb. flanged inlet and may be equipped with female threaded or 125 lb. flanged outlet.

2.07 NEEDLE STOP VALVES

A. For Temperatures to 300 degrees F.: All brass or forged carbon steel construction, union bonnet, threaded ends, built for 1000 psi at 300 degrees F. Acceptable Manufacturers: Marsh Instrument Co., H.O. Trerice Co., Weksler Instruments Co.

2.08 GAGE COCKS

A. Gage Cocks: All brass construction, “T” or lever handles, threaded ends, built for 300 psig hydraulic pressure. Acceptable Manufacturers: Marsh Instrument Company, Mueller Instruments Co., H.O. Trerice Co. and Weksler Instruments Corp.

2.09 BALL VALVES

A. Type BV: 150 psig WSP, 600 psig WOG, 2 piece bronze body, solid blow-out proof stem, teflon seats, chrome plated brass ball, teflon seals, corrosion resistant steel lever handles with vinyl grips, balancing stop, and threaded or solder ends. Acceptable Manufacturers: Conbraco, Hammond, Milwaukee, Nibco, and Watts.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install valves at locations noted on the drawings or specified.

3.02 VALVE APPLICATION SCHEDULE

A. Schedule of valve applications for the different services is as follows:
   1. Cold Water In Buildings and Tunnels (CW) 125 psig and Less:
      a. 3 inch and Less: A or D gates or BV balls, O globes or angles, and S or U checks; or C gates, K globes or angles, and V checks, with solder joint companion flanges.
      b. 4 inch and Up: C gates or BF butterflys, K globes or angles, and V checks.
   2. Compressed Air (A) 125 psig and less:
      a. 2 inches and Less: A gates, J globe or angles, and W checks.
      b. 2-1/2 inches and Up: C gates, K globe or angles, and W checks.
   3. Domestic Hot Water and Circulating (DHW & DHWC) 125 psig and Less:
      a. 3 inch and Less: A or D gates or BV balls, J or O globes or angles, and S or U checks.
      b. 4 inch and Up: C gates or BF butterflys, K globes or angles, and V checks.
   4. Gas - Natural, Manufactured or Mixed Fuel (G) 125 psig and Less:
      a. 2 inch and Less: AB plug valves.
      b. 2-1/2 inch and Up: AA plug valves.
   5. Gas, Bottled Liquified Petroleum (BG): A gates, and J globes or angles, with flared or ferrule copper tubing adapters.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. General support requirements for plumbing piping

B. Support requirements for cast iron piping

C. Pipe support requirements for cast-in-place concrete construction

D. Pipe support requirements for steel/concrete construction

E. Pipe hangers and supports

F. Anchors and attachments

G. Fasteners

H. Shop painting and plating

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Companion high density filler pieces for installation over the top 180 degree surface of pipe or tubing, at points of support where a combination clevis hanger, insulation shield and high density insulating saddle are installed.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Piping Insulation: Section 220700.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Details of trapeze hangers and upper hanger attachments for piping 4 inches in diameter and over. Include the number and size of pipe lines to be supported on each type of trapeze hanger.
   2. Details of pipe anchors.
   3. Details and method of installing sway braces for cast iron soil pipe.

B. Product Data: Catalog sheets, specifications and installation instructions for each item specified except fasteners.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with the applicable requirements of the ASME B31 Piping Codes.
   2. Unless otherwise shown or specified, comply with the requirements of the Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Standards SP-58, and SP-69.
   3. Hang and support cast iron soil pipe and fittings in accordance with the recommendations of the Cast Iron Soil Pipe's Institute's (CISPI) Cast Iron Soil Pipe and Fittings Handbook.

PART 2 PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A. Combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddle with companion high density filler piece.
   1. Insulating saddles and filler pieces shall be of the same thickness and materials as the adjoining pipe insulation. Saddles shall cover the lower 180 degrees of the pipe or tubing, and companion filler pieces shall cover the upper 180 degrees of the pipe or tubing. Physical sizes, gages, etc. of the components of insulated hangers shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAGE	SADDLE LENGTH (Inches)	VAPOR BARRIER JACKET LENGTH (Inches)
Up to 2-1/2	4	16	6	10
3 to 6	4	14	6	10
8 to 14	10	12	12	16
16 and up	10	10	12	16

B. Pipe Insulation Shields: Fabricated of steel, with a minimum arc of 180 degrees, unless otherwise indicated. Shields for use with hangers and supports, with the exception of combination clevis type hangers, shall be in accordance with the following schedule:

PIPE OR TUBING SIZE (Inches)	SHIELD LENGTH (Inches)	SHIELD GAGE
Up to 2-1/2	8	18
3 to 8	10	16
10 to 14	12	12
16 and up	18	10

C. Pipe Covering Protection Saddles: 3/16 inch thick steel, of sufficient depth for the insulation thickness specified, notched so that saddle contact with the pipe is approximately 50 percent of the total axial cross section. Saddles for pipe 12 inches in size and larger shall have a center support.

D. Pipe Hangers: Height adjustable standard duty clevis type, with cross bolt and nut.
   1. Pipe spreaders or spacers shall be used on cross bolts of clevis hangers, when supporting piping 10 inches in size and larger.

E. Adjustable Floor Rests and Base Flanges: Steel.

F. Hanger Rods: Mild, low carbon steel, fully threaded or threaded at each end, with two nuts at each end for positioning rod and hanger, and locking each in place.

G. Riser Clamps: Malleable iron or steel.

H. Rollers: Cast Iron.

2.02 ANCHORS AND ATTACHMENTS

A. Sleeve Anchors (Group II, Type 3, Class 3): Molly's Div./USM Corp. Parasleeve Series, Ramset's Dynabolt Series, or Red Head/Phillips AN, HN, or FS Series.

B. Wedge Anchors (Zinc Plated, Group II, Type 4, Class 1): Hilti's Kwik Bolt Series, Molly's Div./USM Corp. Parabolt PB Series, Ramset's Trubolt T Series, or Red Head/Phillips WS Series.

C. Self-Drilling Anchors (Group III, Type 1): Ramset's RD Series, or Red Head/Phillips S Series.

D. Non-Drilling Anchors (Group VIII, Type 1): Ramset's Dynaset DS Series, Hilti's HDI Series, or Red Head/Phillips J Series.

E. Stud Anchors (Group VIII, Type 2): Red Head/Phillips JS Series.

F. Beam Clamps: Forged steel beam clamp, with weldless eye nut (right hand thread), steel tie rod, nuts, and washers, Grinnell's Fig No. 292 (size for load, beam flange width, and rod size required).

G. Metal Deck Ceiling Bolts: B-Line Systems' Fig. B3019.

H. Continuous Slotted Type Concrete Insert, Galvanized:
   1. Load Rating 800 lbs/ft: Kindorf's D-986.
   2. Load Rating 1500 lbs/ft: Kindorf's D-980.
   3. Load Rating 3000 lbs/ft: Hohmann & Barnard's Inc. Type CS-H.
   4. Load Rating 4500 lbs/ft: Hohmann & Barnard's Inc. Type CS-HD.

I. Threaded Type Concrete Insert: Galvanized ferrous castings, internally threaded to receive 3/4 inch diameter machine bolts.

J. Wedge Type Concrete Insert: Galvanized box-type ferrous castings, designed to accept 3/4 inch diameter bolts having special wedge shaped heads.

2.03 FASTENERS

A. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application; galvanized for high humidity locations, and treated wood; plain finish for other interior locations. Except where shown otherwise on the Drawings, furnish type, size, and grade required for proper installation of the Work.

2.04 SHOP PAINTING AND PLATING

A. Hangers, supports, rods, inserts and accessories used for pipe supports, unless chromium plated, cadmium plated or galvanized shall be shop coated with metal primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper pipe or copper tubing.

B. Hanger supports for chromium plated pipe shall be chromium plated brass.

PART 3 EXECUTION

3.01 PREPARATORY WORK

A. Place inserts into construction form work expeditiously, so as not to delay the Work.

3.02 INSTALLATION

A. Do not hang or support one pipe from another or from ductwork.
   1. Do not bend threaded rod.

B. Support all insulated horizontal piping conveying fluids below ambient temperature, by means of hangers or supports with insulation shields installed outside of the insulation.

C. Space hangers or supports for horizontal piping on maximum center distances as listed in the following hanger schedules, except as otherwise specified, or noted on the Drawings.
   1. For Steel, and Threaded Brass Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1 and under	8
1-1/4 and 1-1/2	9
2	10
2-1/2 and up	12

   1. For Grooved End Steel Pipe:

PIPE SIZE (Inches)	MAXIMUM SPACING (Feet)
1-1/2 and under	7
2 through 4	10
5 and over	12

   1. No pipe length shall be left unsupported between any two coupling joints.
   2. For Copper Pipe and Copper Tubing:

PIPE OR TUBING SIZE (Inches)	MAXIMUM SPACING (Feet)
1-1/2 and under	6
2 and over	10

   1. For Glass Pipe, and Aluminum Tubing:

TYPE	3/4 INCH AND UNDER	1 INCH AND 1-1/4 INCH	1-1/2 INCH AND OVER
	(Maximum Spacing In Feet)		
Glass Pipe	8	8	8
Plastic Tubing	3	5	7
Aluminum Tubing	3	5	7

   1. For Plastic Tubing:

PIPE OR TUBING SIZE (Inches)	MAXIMUM SPACING (Feet)
Under 2 inch	3

2 inch and over	4

1. Cast Iron Soil Pipe:
   a. General:
      1) Where piping is suspended on centers in excess of 18 inches by means of non-rigid hangers, provide sway bracing to prevent horizontal pipe movement.
      2) Additionally, brace piping 5 inches and larger to prevent horizontal movement and/or joint separation. Provide braces, blocks, rodding or other suitable method at each branch opening, or change of direction
   b. For Bell & Spigot Cast Iron Soil Pipe: Space hangers or support pipe at each joint or on maximum centers of 5 feet. Place hangers or supports as close as possible to joints and when hangers or supports do not come within 1 foot of a branch line fitting, install an additional hanger or support at the fitting.
   c. For Hubless Cast Iron Soil Pipe: Space hangers or support pipe at each joint or on maximum centers of 5 feet. Place hanger or supports as close as possible to joints and when hangers or supports do not come within 1 foot of a branch line fitting, install an additional hanger or support at the fitting.
2. For Directional Changes: Install a hanger or support close to the point of change of direction of all pipe runs in either a horizontal or vertical plane.
3. For Concentrated Loads: Install additional hangers or supports, spaced as required and directed, at locations where concentrated loads such as in-line pumps, valves, fittings or accessories occur, to support the concentrated loads.
4. For Branch Piping Runs and Runouts Over 5 feet In Length: Install a minimum of one hanger, and additional hangers if required by the hanger spacing schedules.
5. Parallel Piping Runs: Where several pipe lines run parallel in the same plane and in close proximity to each other, trapeze hangers may be submitted for approval. Base hanger spacing for trapeze type hangers on the smallest size of pipe being supported. Design the entire hanger assembly based on a safety factor of five, for the ultimate strength of the material being used.
6. Support floor drain traps from the overhead construction, with hangers of type and design as required and approved. Overhead supports are not required for floor drain traps installed directly below earth supported concrete floors.

D. Size hanger rods in accordance with the following:

PIPE OR TUBING SIZE (Inches)	**SINGLE ROD HANGER SIZE (Inches)**		**DOUBLE ROD HANGER SIZE (Inches)**	
	PIPE	**TUBING**	**PIPE**	**TUBING**
1/2 to 2	3/8	1/4	3/8	1/4
2-1/2 and 3	1/2	3/8	3/8	1/4
4 and 5	5/8	1/2	1/2	3/8
6	3/4	1/2	5/8	1/2
8, 10 and 12	7/8	5/8	3/4	5/8

1. Size hanger rods, for piping over 12 inches in size and multiple line supports, based on a safety factor of five for the ultimate strength of the materials being used.
2. Secure hanger rods as follows: Install one nut under clevis, angle or steel member; one nut on top of clevis, angle or steel member; one nut inside insert or on top of upper hanger attachment and one nut and washer against insert or on lower side of upper hanger

attachment. A total of four nuts are required for each rod, two at upper hanger attachment and two at hanger.

E. Vertical Piping:
   1. Support vertical risers of piping systems, by means of heavy duty hangers installed close to base of pipe risers, and by riser clamps with extension arms at intermediate floors, with the distance between clamps not to exceed 25 feet, unless otherwise specified. Support pipe risers in vertical shafts equivalent to the aforementioned. Install riser clamps above floor slabs, with the extension arms resting on floor slabs. Provide adequate clearances for risers that are subject to appreciable expansion and contraction, caused by operating temperature ranges.
   2. Support extension arms of riser clamps, secured to risers to be insulated for cold service, 4 inches above floor slabs, to allow room for insulating and vapor sealing around riser clamps.
   3. Support cast iron risers, by means of heavy duty hangers installed close to the base of the pipe risers, and 1/4 inch thick malleable iron or steel riser clamps with extension arms at each floor level, with the distance between clamps not to exceed 25 feet. Support cast iron risers in vertical shafts equivalent to the aforementioned.
   4. Support hubless cast iron risers, by means of heavy duty hangers installed close to the base of the pipe risers, and by malleable iron or steel riser clamps with the extension arms at each floor level, with the distance between clamps or intermediate supports not to exceed 12 feet. Support risers in vertical shafts equivalent to the aforementioned.

F. Floor Supports: Install adjustable yoke rests with base flanges, for the support of piping, unless otherwise indicated on the Drawings. Install supports in a manner, which will not be detrimental to the building structure.

G. Underground Pipe Supports: Firmly bed pipe laid underground, on solid ground along bottom of pipe. Install masonry piers for pipe laid in disturbed or excavated soil or where suitable bearing cannot be obtained. Support pipe, laid proximate to building walls in disturbed or excavated soil, or where suitable bearing cannot be obtained, by means of wall brackets or hold-fasts secured to walls in an approved manner.

3.03 UPPER HANGER ATTACHMENTS

A. General:
   1. Secure upper hanger attachments to overhead structural steel, steel bar joists, or other suitable structural members.
   2. Do not attach hangers to steel decks that are not to receive concrete fill.
   3. Do not attach hangers to precast concrete plank decks less than 2-3/4 inches thick.
   4. Do not use flat bars or bent rods as upper hanger attachments.

B. Attachment to Steel Frame Construction: Provide intermediate structural steel members where required by pipe support spacing. Select steel members for use as intermediate supports based on a minimum safety factor of five.
   1. Do not use drive-on beam clamps.
   2. Do not support piping over 4 inches in size from steel bar joists. Secure upper hanger attachments to steel bar joists at panel points of joists.
   3. Do not drill holes in main structural steel members.
   4. Beam clamps, with tie rods as specified, may be used as upper hanger attachments for the support of piping, subject to clamp manufacturer’s recommended limits.

C. Attachment to Concrete Filled Steel Decks:
   1. New Construction: Install metal deck ceiling bolts.
   2. Existing Construction: Install welding studs (except at roof decks). Do not support a load in excess of 250 lbs from any single welded stud.

3. Do not attach hangers to decks less than 2-1/2 inches thick.

D. Attachment to Cast-In-Place Concrete: Secure to overhead construction by means of cast-in-place concrete inserts.

E. Attachment to Existing Cast-In-Place Concrete:
   1. For piping up to a maximum of 4 inches in size, secure hangers to overhead construction with self-drilling type expansion shields and machine bolts.
   2. Secure hangers to wall or floor construction with single unit expansion shields or self-drilling type expansion shields and machine bolts.

F. Attachment to Cored Precast Concrete Decks (Flexicore, Dox Plank, Spancrete, etc.): Toggle bolts may be installed in cells for the support of piping up to a maximum of 2-1/2 inches in size.

G. Attachment to Hollow Block or Hollow Tile Filled Concrete Decks:
   1. New Construction: Omit block or tile and pour solid concrete with cast-in-place inserts.
   2. Existing Construction: Break out block or tile to access, and install machine bolt anchors at highest practical point on side of web.

H. Attachment to Waffle Type Concrete Decks:
   1. New Construction: Install cast-in-place inserts.
   2. Existing Construction: Install machine bolt expansion anchors at highest practical point on side of web.

I. Attachment to Precast Concrete Tee Construction:
   1. New Construction: Tee hanger inserts between adjacent flanges, except at roof deck without concrete fill.
   2. Existing Construction: Dual unit expansion shields in webs of tees. Install shields as high as possible in the webs.
      a. Exercise extreme care in the field drilling of holes to avoid damage to reinforcing.
      b. Do not use powder driven fasteners.

3.04 ANCHORS, RESTRAINTS, RIGID SUPPORTS, STAYS AND SWAY BRACES

A. Cast Iron Soil Piping Systems:
   1. Where piping is suspended on centers in excess of 18 inches by means of non-rigid hangers, provide sway braces, of design, number and location in accordance with the Cast Iron Soil Pipe Institute's Cast Iron Soil Pipe and Fittings Handbook to prevent horizontal pipe movement.
   2. Additionally, brace piping 5 inches and larger to prevent horizontal movement and/or joint separation. Provide braces, blocks, rodding or other suitable method at each branch opening, or change of direction in accordance with the Cast Iron Soil Pipe Institute's Cast Iron Soil Pipe and Fittings Handbook to prevent horizontal pipe movement.

3.05 PIPING IN TUNNELS

A. Support piping in tunnels on adjustable stanchions, fabricated in accordance with the details on the Drawings, unless otherwise indicated. Install, secure and be responsible for the proper locations of all cast-in-place inserts and stanchion supports, in ample time so as not to delay construction Work. Secure tops of stanchions to overhead construction, as required and approved.

3.06 COMBINATION CLEVIS HANGER, PIPE INSULATION SHIELD AND VAPOR BARRIER JACKETED HIGH DENSITY INSULATING SADDLES

A. Install a combination clevis hanger, pipe insulation shield and vapor barrier jacketed high density insulating saddles, at all points of support for piping or tubing to be insulated for cold service. Furnish companion high density vapor barrier jacketed saddle pieces, of the same material, thickness and length, for installation over the top 180 degree surface of pipe or tubing, at each point of support where an insulated clevis hanger is utilized.

3.07 PIPE INSULATION SHIELDS

A. Unless otherwise specified, install a pipe insulation shield, at all points of support. Center shields on all hangers and supports outside of high density insulation insert, and install in such a manner so as not to cut, or puncture jacket.

3.08 PIPE COVERING PROTECTION SADDLES

A. Install pipe covering protection saddles at all points of support, for steel piping 6 inches in size and larger, insulated with hot service insulation. Weld saddles to piping to insure movement with pipe.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General concrete pad requirements

B. Requirements for exterior pads

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Subbase for Concrete Pads: Section 310000.

1.03 REFERENCES

A. Except as shown or specified otherwise, the Work of this Section shall conform to the requirements of Specifications for Structural Concrete for Buildings ACI 301-99 of the American Concrete Institute.

1.04 SUBMITTALS

A. Submittals Package: Submit product data for design mix and materials for concrete specified below at the same time as a package.

B. Shop Drawings: Placing drawings for bar reinforcement.

C. Product Data:
   1. Concrete design mix with name and location of batching plant.
   2. Portland Cement: Brand and manufacturer's name.
      a. Fly Ash: Name and location of source, and DOT test numbers.
   3. Air-Entraining Admixture: Brand and manufacturer's name.
   4. Aggregates: Name and location of source, and NYS test numbers.
   5. Bonding Agent (Adhesive): Brand and manufacturer's name, and preparation and application instructions.

D. Samples:
   1. Fabric Reinforcement: 8 inches square.
   2. Bar Supports: Full size.

E. Quality Control Submittals:
   1. Certificates: Bar reinforcement manufacturer's certification that bar material conforms with ASTM A 615 and specified grade.

1.05 STORAGE

A. Store materials as required to insure the preservation of their quality and fitness for the Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Anchor Bolts: Standard bolts, ASTM A 307, with lock washers and nuts.

B. Steel Plates: ASTM A 36.

C. Sleeves: Steel Pipe, Schedule 40, black, ASTM A 53.

D. Steel Shims and Fillers: ASTM A 569.

E. Reinforcement: Furnish the following unless otherwise indicated on the Drawings:
   1. Fabric Reinforcement: ASTM A 185 welded wire fabric, 6 x 6 - W2.9 x W2.9 fabricated into flat sheets unless otherwise indicated.
   2. Bar Reinforcement: ASTM A 615, Grade 60, deformed.
   3. Metal Bar Supports: Galvanized or AISI Type 430 stainless steel, and without plastic tips.
   4. Tie Wire: Black annealed wire, 16 gage minimum.

F. Fly Ash: ASTM C 618, including Table 1A (except for footnote A), Class F except that loss on ignition shall not exceed 4.0 percent.

2.02 PROPORTIONING OF CONCRETE MIXES

A. Compressive Strength: Minimum 4000 psi.

B. Weight: Normal.

C. Durability: Concrete shall be air-entrained. Design air content shall be 6 percent by volume, with an allowable tolerance of plus or minus 1.5 percent for total air content. Entrained air shall be provided by use of an approved air-entraining admixture. Air-entrained cement shall not be used.

D. Slump: Between 2 inches and 4 inches.

E. Admixtures: Do not use admixtures in concrete unless specified or approved in writing by the Director.

F. Selection of Proportions: Concrete proportions shall be established on the basis of previous field experience or laboratory trial batches, unless otherwise approved in writing by the Director. Proportion mix with a minimum cement content of 611 pounds per cubic yard for 4000 psi concrete.
   1. Optional Material: Fly ash may be substituted for (Portland) cement in normal weight concrete up to a maximum of 15 percent by weight of the required minimum (Portland) cement. If fly ash is incorporated in a concrete design mix, make necessary adjustments to the design mix to compensate for the use of fly ash as a partial replacement for (Portland) cement.
      a. Adjustments shall include the required increase in air-entraining admixture to provide the specified air content.

2.03 FABRICATION OF ANCHOR BOLT ASSEMBLIES

A. Bolts: Diameter 1/8 inch less than the bolt holes in the equipment supports and length equal to the depth of the pad minus 1 inch plus the additional length required to provide full thread through nuts after shims, equipment, and washers are in place.

B. Sleeves: Diameter 1/2 inch larger than the bolt diameter and length as required to extend from the head of the bolt to the top of the pad.

C. Plates: 3 x 3 x 1/4 inch steel plate.

D. Weld a plate to the head end of a bolt. Center the bolt in a sleeve and tack-weld the sleeve to the plate.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Concrete materials, reinforcement, forms, and earth which will be in contact with fresh concrete shall be free from frost at the time of concrete placement.

3.02 INSTALLING ANCHOR BOLTS AND SLEEVES

A. Install anchor bolts (with sleeves) for all bolt holes in equipment supports.

B. Accurately position and securely support anchor bolts and sleeves prior to placing concrete. Support head of bolt 1 inch above bottom of pad. Temporarily close open end of sleeves to prevent entry of concrete.

C. Grout anchor bolts in sleeves with cement grout or approved shrink-resistant grout after final positioning.

3.03 REINFORCING

A. Except where other reinforcement is shown on the Drawings, install welded wire fabric at mid-depth of each pad, extending to 1 inch from perimeter of pad.

3.04 FINISHES

A. Formed Surfaces: Provide a smooth rubbed finish, with rounded or chamfered external corners, on all concrete surfaces exposed to view.

B. Unformed Surfaces: Provide a troweled finish on top surface of pads.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Pipe markers and accessories

B. Pipe service identification tags

C. Valve service identification tags

D. Valve service identification chart frames

1.02 REFERENCES

A. ANSI A13.1 - Scheme for Identification of Piping Systems.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each item specified.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. W.H. Brady Co., Milwaukee, WI.

B. Emed Co., Buffalo, NY.

C. Panduit Corp., Tinley Park, IL.

D. Seton Nameplate Corp., New Haven, CT.

2.02 PIPE MARKERS AND ACCESSORIES

A. Snap-on Marker: One piece wrap around type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, 3/4 inch adhesive strip on inside edge, and 360 degree visibility.

B. Strap-On Marker: Strip type constructed of precoiled acrylic plastic with clear polyester coating, integral flow arrows, legend printed in alternating directions, factory applied grommets, and pair of stainless steel spring fasteners.

C. Stick-On Marker: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, and integral flow arrows for applications where flow arrow banding tape is not being used.

D. Pipe Marker Legend and Color Field Sizes:

OUTSIDE DIAMETER OF PIPE OR INSULATION (Inches)	LETTER SIZE (Inches)	LENGTH OF COLOR FIELD (Inches)
3/4 to 1-1/4	1/2	8
1-1/2 to 2	3/4	8
2-1/2 to 6	1-1/4	12

8 to 10	2-1/2	24
Over 10	3-1/2	32

E. Banding Tapes: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating.
   1. Plain Tape: Unprinted type; color to match pipe marker background.
   2. Flow Arrow Tape: Printed type with integral flow arrows; color to match pipe marker background.

F. Pipe Size Labels: Pressure sensitive adhesive backed type constructed of vinyl with clear polyester coating, vertical reading pipe size in inches, and legend size matching adjacent pipe marker.

2.03 PIPE SERVICE IDENTIFICATION TAGS

A. Type: No. 19 B & S gage brass, with 1/4 inch high pipe service abbreviated legend on one line, over 1/2 inch high pipe size legend in inches, both deep stamped and black filled; and 3/16 inch top hole for fastener.

B. Size: 2 inch square tag.

C. Fasteners: Brass “S” hook or brass jack chain of size as required for pipe to which tag is attached.

2.04 VALVE SERVICE IDENTIFICATION TAGS

A. Type: No. 19 B & S gage brass, with 1/4 inch high valve service abbreviated lettering on one line over 1/2 inch high valve service chart number, both deep stamped and black filled; and with 3/16 inch top hole for fastener.

B. Sizes:
   1. Plumbing Use: 1-1/2 inch hexagon.

C. Fasteners: Brass “S” hook or brass jack chain of size as required for valve stem or handle to which tag is attached.

2.05 VALVE SERVICE IDENTIFICATION CHART FRAMES

A. Type: Satin finished extruded aluminum frame with rigid clear plastic glazing, size to fit 8-1/2 x 11 inches valve chart.

PART 3 EXECUTION

3.01 PREPARATION

A. Complete testing, insulation and finish painting work prior to completing the Work of this Section.

B. Clean pipe surfaces with cleaning solvents prior to installing piping identification.

C. Remove dust from insulation surfaces with clean cloths prior to installing piping identification.

3.02 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

B. Stick-On Pipe Markers:
   1. Install minimum of 2 markers at each specified location, 90 degrees apart on visible side of pipe.
   2. Encircle ends of pipe markers around pipe or insulation with banding tape with one inch lap. Use plain banding tape on markers with integral flow arrows, and flow arrow banding tape on markers without integral flow arrows.

C. Pipe Size Labels: Install labels adjacent to each pipe marker and upstream from flow arrow. Install a minimum of 2 pipe size labels at each specified location, 90 degrees apart on visible side of pipe.

D. Pipe Service Identification Tags: Attach tags to piping being identified with "S" hooks or jack chains.

3.03 PIPING IDENTIFICATION SCHEDULE

A. Piping Identification Types:
   1. Piping or Insulation under 3/4 inch od: Pipe identification tags.
   2. Piping or Insulation 3/4 inch to 5-7/8 inch od: Snap-on marker or stick-on marker.
   3. Piping or Insulation 6 inch od and Larger: Strap-on marker or stick-on marker.

B. Identify exposed piping, bare or insulated, as to content, size of pipe and direction of flow, with the following exceptions:
   1. Piping in non-walk-in tunnels or underground conduits between manholes.
   2. Piping in furred spaces or suspended ceilings, except at valve access panels where valves and piping shall be identified as specified for exposed piping systems.
   3. Piping in finished spaces such as offices, class rooms, wards, toilet rooms, shower rooms and spaces as specified.

C. Locate piping identification to be visible from exposed points of observation.
   1. Locate piping identification at valve locations; at points where piping enters and leaves a partition, wall, floor or ceiling, and at intervals of 20 feet on straight runs.
   2. Where 2 or more pipes run in parallel, place printed legend and other markers in same relative location.

3.04 VALVE IDENTIFICATION SCHEDULE

A. Valve Service Identification Tags:
   1. Tag control valves, except valves at equipment, with a brass tag fastened to the valve handle or stem, marked to indicate service and numbered in sequence for the following applications:
      a. Domestic water valves controlling mains, risers and branch runouts.
      b. Gas valves controlling mains, risers, and branch runouts.
      c. Valves in sprinkler and fire standpipe systems, except hose valves.

B. Valve Service Identification Charts:
   1. Provide 2 framed valve charts for each piping system specified to be provided with valve identification tags. Type charts on 8-1/2 x 11 inches heavy white bond paper, indicating valve number, service and location.

2. Hang framed charts at locations as directed.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Cleanout plug

B. Cleanout

C. Cleanout wall plate

D. Cleanout deck plate

E. Grease trap

F. Air gap fitting

G. Indirect waste funnel

H. Fasteners

1.02 REFERENCES

A. Comply with the applicable requirements of ASME A112.36.2M - Cleanouts, and ASME A112.1.2 - Drainage Funnels and Air Gaps.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, specifications, and installation instructions for each item specified except fasteners.

1.04 MAINTENANCE

A. Special Tools: Deliver the following to the Director's Representative:
   1. Tools for Vandal Resistant Fasteners: One for each type and size.
   2. T-Handle Wrench for Cleanout Plugs: One for each type and size.

PART 2 PRODUCTS

2.01 CLEANOUT PLUG

A. Cast brass or bronze, with threaded end, and raised or countersunk head.
   1. Tapped head for attachment of cleanout wall or deck plate covers where required.

B. Anti-Seize Lubricant: Never-Seez by Bostik Chemical Group, Broadview, IL; Molycote 1000 by Dow Corning Corp, Midland, MI; Anti-Seize Lubricant by Loctite Corp, Newington, CT.

2.02 CLEANOUT

A. Threaded pipe fitting or cast iron ferrule with gas tight cleanout plug.

2.03 CLEANOUT WALL PLATE

A. Round, stainless steel or polished chrome plated bronze cover plate with stainless steel vandal resistant fastener to secure to cleanout plug.

2.04 CLEANOUT DECK PLATE

A. Standard duty floor cleanout fitting with coated cast iron body; round, polished nickel bronze scoriated top secured to cleanout plug with stainless steel vandal resistant fastener; threaded height adjustment, cast iron head, gas tight cleanout plug, and connection to match piping option selected.

B. Membrane flange and clamping collar, secured with corrosion resistant fasteners.

2.05 GREASE TRAP

A. Cast iron or steel construction with threaded inlet and outlet connections, removable baffles or screens, bolted and gasketed cover with recessed lift rings or grip holes.
   1. Finish: Factory enamel coated inside and outside.
   2. Non-skid cover top surface.

B. Provide built-in flow control or adjustable flow control fitting for installation in system piping.

2.06 AIR GAP FITTING

A. Coated cast iron body with air gaps, set screw or threaded inlet, and outlet connection to match piping option selected.

2.07 INDIRECT WASTE FUNNEL

A. Combination Funnel Drain and P Trap: Polished chrome plated cast brass construction.
   1. Funnel: 4 inch top dia., 4 inches deep, with threaded outlet.
   2. P Trap: Bottom cleanout, threaded inlet, and outlet connection to match piping option selected.

2.08 FASTENERS

A. Corrosion Resistant Fasteners: Brass, bronze, or Type 302 or 304 stainless steel bolts.

B. Vandal Resistant Fasteners: Torx head with center pin.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer’s printed installation instructions, unless otherwise specified.

B. Cleanout Plug: Lubricate threads with anti-seize lubricant before final installation.

C. Grease Trap: Set flow control as recommended by the manufacturer’s instructions.

D. Secure external components in place with vandal resistant fasteners or devices which cannot be removed without special tools.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Floor drain for installation in concrete flooring

B. Floor sink

C. Fasteners

1.02 REFERENCES

A. Unless otherwise specified, the Work of this section shall meet the applicable requirements of FS WW-P-541 - Plumbing Fixtures, and ASME A112.21.1M - Floor Drains.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each type drain specified.

1.04 MAINTENANCE

A. Special Tools: Deliver to the Building Owner.

B. Tools for Vandal Resistant Fasteners: One for each type and size.

PART 2 PRODUCTS

2.01 FLOOR DRAIN – CONCRETE FLOORING

A. Drain Body: Coated cast iron, two-piece body with reversible flashing clamp, minimum 9 inch dia drainage flange, corrosion resistant bolts, weep holes, bottom outlet, and connection to match piping option selected.

B. Strainer Head: Round, minimum 7 inch dia, nickel bronze with threaded shank for height adjustment.

C. Strainer Grate: Polished nickel bronze, heel proof; secured with stainless steel vandal resistant fasteners.

D. Acceptable Drain Series: Josam 30000A, Smith 2010A, Wade W1100, and Zurn Z415.

2.02 FLOOR SINK

A. Drain Body: 12”x12” coated cast iron, 6” receptor with recessed dome strainer and grating. Interior body to be coated with white acid resistant porcelain enamel.

B. Strainer Dome: ABS anti-splash interior dome strainer

C. Strainer Grate: Light Duty Cast Iron acid resistant coating with ½” slotted opening.
   1. 3/4 grate for (1) pipe discharge
   2. 1/2 grate for (2-3) pipe discharges
   3. No grate for more than 3 pipe discharges
   4. Acceptable Drain Series: Watts FS-710, Sioux Chief 861, Mifab FS1520, and Zurn Z1900.

2.03 FASTENERS

A. Corrosion Resistant Fasteners: Brass, bronze, or Type 302 or 304 or stainless steel bolts.

B. Vandal Resistant Fasteners: Torx head with center pin.

2.04 FREE AREA OF GRATE

A. Minimum strainer grate free area listed below for each connecting pipe size:

CONNECTING PIPE SIZE (Inches Nominal)	INTERIOR DRAINS FREE AREA (Square Inches)	EXTERIOR DRAINS FREE AREA (Square Inches)
1-1/2	3.06	4.08
2	4.71	6.28
3	10.59	14.12
4	18.90	25.20
5	29.40	39.20
6	42.45	56.60
8	75.38	100.50

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

B. Protect weep holes from plugging during installation. Rod out weep holes after installation to remove obstructions.

C. Set drainage flange flush with top of structural floor slab, or at elevation otherwise indicated.

D. After membrane waterproofing installed and cured, secure clamping ring.

E. Adjust strainer head to height indicated. If height not indicated, set at 1/2 inch below finished floor elevation.

F. Secure external components in place with vandal resistant fasteners or devices which cannot be removed without special tools.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Piping insulation

B. Insulation jackets

C. Adhesives, mastics, and sealers

D. Miscellaneous materials

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Through Penetration Firestops: Section 078400.

B. Painting: Section 099103.

C. Pipe Hangers and Supports: Section 220529.

1.03 ABBREVIATIONS

A. FS: Federal Specification.

B. K: Thermal Conductivity, i.e., maximum Btu per inch thickness per hour per square foot.

C. pcf: Pounds per cubic foot.

D. PVC: Polyvinylchloride.

1.04 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications and installation instructions for the following:
   1. Insulation Materials.
   2. Jacket Materials.

B. Quality Control Submittals:
   1. Installers Qualification Data:
      a. Name of each person who will be performing the Work, and their employer's name, business address and telephone number.
      b. Furnish names and addresses of the required number of similar projects that each person has worked on which meet the qualifications.

1.05 QUALITY ASSURANCE

A. Qualifications: The persons installing the Work of this Section and their Supervisor shall be personally experienced in mechanical insulation work and shall have been regularly employed by a company installing mechanical insulation for a minimum of 5 years.

B. Regulatory Requirements:
   1. Insulation installed inside buildings, including laminated jackets, mastics, sealants and adhesives shall have a Fire Spread/Smoke Developed Rating of 25/50 or less based on ASTM E 84.

PART 2 PRODUCTS

2.01 PIPING INSULATION

A. Fibrous Glass (Mineral Fiber) Insulation: Composed principally of fibers manufactured from rock, slag, or glass, with or without binders, and asbestos free.
   1. Preformed Pipe Insulation: Minimum density 3 pcf; ASTM C 547:
      a. Class 1 (Suitable for Temperatures Up to 450 degrees F): K of 0.26 at 75 degrees F.
   2. Premolded Fitting Insulation: Minimum density 4.0 pcf, K of 0.26 at 75 degrees F; ASTM C 547, Class 1.
   3. Insulation Inserts for PVC Fitting Jackets: Minimum density 1.5 pcf, K of 0.28 at 75 degrees F; ASTM C 553, Type III.
      a. Suitable for temperatures up to 450 degrees F.

B. Flexible Elastomeric Foam Insulation:
   1. FM tested and approved, meeting the following:
      a. Maximum Water Vapor Transmission: 0.10 perm - inch based on ASTM E 96, Procedure A.
      b. K of 0.27 at 75 degrees F based on ASTM C 518 or C 177.
      c. Fire Spread/Smoke Developed Rating: 25/50 or less based on ASTM E 84.
   2. Pipe Insulation: ASTM C 534, Type I.
   3. Polyethylene and polyolefin insulation is not acceptable.

C. High Density Jacketed Insulation Inserts for Hangers and Supports:
   1. For Use with Fibrous Glass Insulation:
      a. Cold Service Piping:
         1) Polyurethane Foam: Minimum density 4 pcf, K of 0.13 at 75 degrees F, minimum compressive strength of 125 psi.
      b. Hot Service Piping:
         1) Calcium Silicate: Minimum density 15 pcf, K of 0.50 at 300 degrees F; ASTM C 533.
         2) Perlite: Minimum density 12 pcf, K of 0.60 at 300 degrees F; ASTM C 610.
   2. For Use with Flexible Elastomeric Foam Insulation: Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as specified or required.

D. Cements:
   1. Fibrous Glass Thermal Insulating Cement: Asbestos free; ASTM C 195.
   2. Fibrous Glass Hydraulic Setting Thermal Insulating and Finishing Cement: ASTM C 449/C 449M.

2.02 INSULATION JACKETS

A. Laminated Vapor Barrier Jackets for Piping: Factory applied by insulation manufacturer, conforming to ASTM C 1136, Type I.
   1. Type I: Reinforced white kraft and aluminum foil laminate with kraft facing out.
      a. Pipe Jackets: Furnished with integral 1-1/2 inch self sealing longitudinal lap, and separate 3 inch wide adhesive backed butt strips.
   2. Laminated vapor barrier jackets are not required for flexible elastomeric foam insulation.

B. Canvas Jackets: Cotton duck, fire retardant, complying with NFPA 701, 4 oz or 6 oz per sq yd as specified.

C. Premolded PVC Fitting Jackets:
   1. Constructed of high impact, UV resistant PVC.

a. ASTM D 1784, Class 14253-C.
b. Working Temperature: 0-150 degrees F.

D. Under Lavatory Piping Protection Cover: ADA compliant.
1. Construction: 1/8 inch thick chemical, microbial, and fungal resistant, injection molded smooth PVC vinyl with internal ribs.
2. Fasteners: Reusable, finger press internal fasteners presenting no sharp or abrasive external surfaces.
3. Cover Trimming: Tear on internal, dimensioned tear lines for proper fit.
4. Kit includes covering for 8 inch tailpiece-trap, 8 inch waste arm, hot and cold water supplies and valves, and required fasteners.
5. Acceptable Covers:
a. Lav Guard 2, E-Z Series by IPS Corp., 202 Industrial Park Lane, Collierville, TN 38017, (800) 340-5969, www.truebro.com.
b. Pro-Extreme Series by Plumberex, P.O. Box 1684, Palm Springs, CA 92263, (800) 475-8629, www.plumberex.com.

2.03 ADHESIVES, MASTICS, AND SEALERS

A. Lagging Adhesive (Canvas Jackets): Childers' CP-50AMV1, Epolux's Cadalag 336, Foster's 30-36.

B. Vapor Lap Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-60 or 85-20.

C. Vapor Barrier Mastic(Fibrous Glass Insulation): Permeance shall be .03 perms or less at 45 mils dry per ASTM E 96. Childers' CP-34, Epolux's Cadalar 670, Foster's 30-65.

D. Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-82, Epolux's Cadoprene 488, Foster's 85-75. 5 gallon cans only

E. Adhesive (Fiberglass Duct Liner): Childers' Chil Quick CP-127, Foster Vapor Fas 85-60. Must comply with ASTM C 916, Type II

F. Weather Barrier Breather Mastic (Reinforcing Membrane): Childers' VI-CRYL CP-10/11, Foster's Weatherite 46-50.

G. Sealant (Metal Pipe Jacket): Non hardening elastomeric sealants. Foster Elastolar 95-44, Childers Chil Byl CP-76, Pittsburgh Corning 727

H. Reinforcing Membrane: Childers' Chil Glas #10, Foster Mast a Fab, Pittsburgh Corning PC 79

2.04 MISCELLANEOUS MATERIALS

A. Pressure Sensitive Tape for Sealing Laminated Jackets:
1. Acceptable Manufacturers: Alpha Associates, Ideal Tape, Morgan Adhesive.
2. Type: Same construction as jacket.

B. Wire, Bands, and Wire Mesh:
1. Binding and Lacing Wire: Nickel copper alloy or copper clad steel, gage as specified.
2. Bands: Galvanized steel, 1/2 inch wide x 0.015 inch thick, with 0.032 inch thick galvanized wing seals.
3. Wire Mesh: Woven 20 gage steel wire with 1 inch hexagonal openings, galvanized after weaving.

C. Reinforcing Membrane: Glass or Polyester, 10 x 10 mesh. Alpha Associates Style 59, Childer's Chil-Glas, Foster's MAST-A-FAB.

PART 3 EXECUTION

3.01 PREPARATION

A. Perform the following before starting insulation Work:
   1. Install hangers, supports and appurtenances in their permanent locations.
   2. Complete testing of piping.
   3. Clean and dry surfaces to be insulated.

3.02 INSTALLATION, GENERAL

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions unless otherwise specified.

B. Provide continuous piping insulation and jacketing when passing thru interior wall, floor, and ceiling construction.
   1. At Through Penetration Firestops: Coordinate insulation densities with the requirements of approved firestop system being installed. See Section 078400.
      a. Insulation densities required by approved firestop system may vary with the densities specified in this Section. When this occurs use the higher density insulation.

C. Do not intermix different insulation materials on individual runs of piping.

D. All water, soil, and waste piping exposed to freezing temperatures shall be protected from freezing by insulation, heat, or both. This included piping in unheated garages, building overhangs, and exposed storm piping.

3.03 INSTALLATION AT HANGERS AND SUPPORTS

A. Reset and realign hangers and supports if they are displaced while installing insulation.

B. Install high density jacketed insulation inserts at hangers and supports for insulated piping.

C. Insulation Inserts For Use with Fibrous Glass Insulation:
   1. Where clevis hangers are used, install insulation shields and high density jacketed insulation inserts between shield and pipe.
      a. Where insulation is subject to compression at points over 180 degrees apart, e.g. riser clamps, U-bolts, trapezes, etc.; fully encircle pipe with 2 protection shields and 2 high density jacketed fibrous glass insulation inserts within supporting members.
         1) Exception: Locations where pipe covering protection saddles are specified for hot service piping, 6 inch and larger.

D. Insulation Inserts For Use with Flexible Elastomeric Foam Insulation:
   1. Where clevis hangers are used, install insulation shields with hardwood filler pieces, same thickness as adjoining insulation, inserted in undersized die cut or slotted holes in insulation at support points.
   2. Contour hardwood blocks to match the curvature of pipe, and shield.
   3. Coat dowels and blocks with insulation adhesive, and insert while still wet.
   4. Vapor seal outer surfaces of dowels and blocks with adhesive after insertion.
   5. Install filler pieces as follows:

PIPE/TUBING SIZE	FILLER PIECES	POSITION

Thru 1-1/2”	2 dowel plugs	6 o’clock; in tandem
2” thru 4”	1 block, 2 dowel plugs	6 o’clock, and 4 & 8 o’clock respectively
6” thru 8”	2 blocks, 4 dowel plugs	6 o’clock; in tandem and 4 & 8 o’clock; in tandem

3.04 INSTALLATION OF FIBROUS GLASS COLD SERVICE INSULATION

A. Install insulation materials with a field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket, unless otherwise specified.

B. Piping:
   1. Butt insulation joints together, continuously seal minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide butt adhesive backed strips.
      a. Substitution: 3 inch wide pressure sensitive sealing tape, of same material as jacket, may be used in lieu of butt strips.
   2. Bed insulation in a 2-inch wide band of vapor barrier mastic, and vapor seal exposed ends of insulation with vapor barrier mastic at each butt joint between pipe insulation and equipment, fittings or flanges at the following intervals:
      a. Horizontal Pipe Runs: 21 ft.
      b. Vertical Pipe Runs: 9 ft.

C. Fittings, Valves, Flanges and Irregular Surfaces:
   1. Insulate with mitre cut or premolded fitting insulation of same material and thickness as pipe insulation.
   2. Secure insulation in place with 16-gage wire, with ends twisted and turned down into insulation.
   3. Butt insulation against pipe insulation and bond with joint sealer.
   4. Insulate valves up to and including bonnets, without interfering with packing nuts.
   5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.
   6. When insulating cement has dried, seal fitting, valve and flange insulation, by imbedding a layer of reinforcing membrane or 4 oz. canvas jacket between 2 flood coats of vapor barrier mastic, each 1/8 inch thick wet.
   7. Lap reinforcing membrane or canvas on itself and adjoining pipe insulation at least 2 inches.
   8. Trowel, brush or rubber glove outside coat over entire insulated surface.
   9. Exceptions:
      a. Type C and D Piping Systems: Valves, fittings and flanges may be insulated with premolded PVC fitting jackets, with fibrous glass insulation inserts.
         1) Additional insulation inserts are required for services with operating temperatures under 45 degrees F or where insulation thickness exceeds 1-1/2 inches. The surface temperature of PVC fitting jacket must not go below 45 degrees F.

3.05 INSTALLATION OF FIBROUS GLASS HOT SERVICE INSULATION

A. Install insulation materials with field or factory applied ASTM C 1136 Type I laminated vapor barrier jacket unless otherwise specified.

B. Canvas Jackets on Piping, Fittings, Valves, Flanges, Unions, and Irregular Surfaces:
   1. For Piping 2 inch Size and Smaller: 4 oz per sq yd unless otherwise specified.
   2. For Piping Over 2 inch Size: 6 oz per sq yd unless otherwise specified.

C. Piping:
   1. Butt insulation joints together, continuously seal minimum 1-1/2 inch wide self-sealing longitudinal jacket laps and 3-inch wide adhesive backed butt strips.
      a. Substitution: 3 inch wide pressure sensitive sealing tape, of same material as the jacket, may be used in lieu of butt strips.
   2. Fill voids in insulation at hanger with insulating cement.
   3. Exceptions:
      a. Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Spaces and Concealed Piping: Butt insulation joints together and secure minimum 1-1/2 inch wide longitudinal jacket laps and 3 inch wide butt strips of same material as jacket, with outward clinching staples on maximum 4 inch centers. Fill voids in insulation at hangers with insulating cement.

D. Fittings, Valves, Flanges and Irregular Surfaces:
   1. Insulate with mitre cut or premolded fitting insulation of same material and thickness as insulation.
   2. Secure in place with 16-gage wire, with ends twisted and turned down into insulation.
   3. Butt fitting, valve and flange insulation against pipe insulation, and fill voids with insulating cement.
   4. Insulate valves up to and including bonnets, without interfering with packing nuts.
   5. Apply leveling coat of insulating cement to smooth out insulation and cover wiring.
   6. After insulating cement has dried, coat insulated surface with lagging adhesive, and apply 4 oz or 6 oz canvas jacket as required by pipe size.
      a. Lap canvas jacket on itself and adjoining pipe insulation at least 2 inches.
      b. Size entire canvas jacket with lagging adhesive.
   7. Exceptions:
      a. In Types E, and F Service Piping Systems: Valves, fittings and flanges may be insulated with premolded PVC fitting jackets, with fibrous glass insulation inserts.
         1) Additional insulation inserts are required for services with operating temperatures over 250 degrees F or where insulation thickness exceeds 1-1/2 inches. The surface temperature of PVC fitting jacket must not exceed 150 degrees F.
      b. In Types E, and F Service Piping Systems: Insulate fittings, valves, and irregular surfaces 3 inch size and smaller with insulating cement covered with 4 oz or 6 oz canvas jacket as required by pipe size.
         1) Terminate pipe insulation adjacent to flanges and unions with insulating cement, trowelled down to pipe on a bevel.
      c. Fittings, Valves, Flanges, and Irregular Surfaces In Concealed Piping, Piping in Accessible Shafts, Attic Spaces, Crawl Spaces, Unfinished Rooms, Unfinished Spaces, and Tunnels: Sizing of canvas surface is not required.

3.06 INSTALLATION OF FLEXIBLE ELASTOMERIC FOAM INSULATION

A. Where possible, slip insulation over the pipe, and seal butt joints with adhesive.
   1. Where the slip-on technique is not possible, slit the insulation and install.
   2. Re-seal with adhesive, making sure the mating surfaces are completely joined.

B. Insulate fittings and valves with miter cut sections. Use templates provided by the manufacturer, and assemble the cut sections in accordance with the manufacturer’s printed instructions.
   1. Insulate threaded fittings and valves with sleeved fitting covers. Over lap and seal the covers to the adjoining pipe insulation with adhesive.

C. Carefully mate and seal with adhesive all contact surfaces to maintain the integrity of the vapor barrier of the system.

D. Piping Exposed Exterior to a Building, Totally Exposed to the Elements:
   1. Apply flexible elastomeric foam insulation to piping with adhesive.
   2. Apply reinforcing membrane around piping insulation with adhesive or mastic.
   3. Adhesive Applied System: Apply 2 coats of finish. See Section 099103.
   4. Mastic Applied System: Apply another coat of mastic over reinforcing membrane.

3.07 INSTALLATION OF SHEET METAL JACKETING ON PIPING

A. Secure jacketing to insulated piping with preformed aluminum snap straps and stainless steel strapping installed with special banding wrench.

B. Jacket exposed insulated fittings, valves and flanges with mitred sections of aluminum jacketing.
   1. Seal joints with sealant and secure with preformed aluminum bands.

3.08 FIELD QUALITY CONTROL

A. Field Samples: The Director's Representative, may at their discretion, take field samples of installed insulation for the purpose of checking materials and application. Reinsulate sample cut areas.

3.09 PIPING INSULATION SCHEDULE

A. Insulate all cold service and hot service piping, and appurtenances except where otherwise specified.

B. Schedule of Items Not to be Insulated:
   1. Chrome plated piping, unless otherwise specified.
   2. Exposed piping in finished spaces, serving one fixture, or piece of equipment, and which connection from the main, branch, or riser, is 24 inches or less in length.
   3. Water heater blow-off piping.
   4. Air vents, pressure reducing valves, pilot lines, safety valves, relief valves.
   5. Water meters.
   6. Piping buried in the ground, unless otherwise specified herein.
   7. Items installed by others, unless otherwise specified herein.
   8. Sanitary drainage piping, unless otherwise specified herein.
   9. Mechanical equipment with factory applied steel jacket.
   10. Hot service piping 81 degrees F to 104 degrees F.
   11. Flanges and unions in Type E, F, and G service piping systems.
   12. Sprinkler and standpipe piping, unless otherwise specified.

3.10 COLD SERVICE INSULATION MATERIAL SCHEDULE

TYPE	SERVICE AND TEMPERATURES	INSULATION MATERIAL	PIPE SIZES (INCHES)	MINIMUM (NOMINAL) INSULATION THICKNESS (INCHES)

C	Fluids (except domestic cold water) 40 F to 80 F.	Flex. Elastomeric Foam or Fibrous Glass	1-1/2 & less Over 1-1/2	1 1-1/2
D	Domestic cold water, and as specified. 33 F to 80 F.	Flex. Elastomeric Foam or Fibrous Glass	All Sizes	1/2

A. NOTES:
   1. Sprinkler and Standpipe Piping (First 10 feet connected to domestic water main within building): Insulate with same materials and thicknesses specified for domestic cold water.
   2. Roof Drain Bodies Below Roof, Horizontal Conductor Piping Including Drops, and First Fitting on Vertical conductor: Insulate with same materials and thicknesses specified for domestic cold water.
   3. Piping Serving Handicapped Accessible Lavatories:
      a. Insulate exposed hot and cold water supply, and waste piping with under lav piping protection cover. Install fasteners thru each pair of holes in insulated safety wrap.

3.11 HOT SERVICE INSULATION MATERIAL SCHEDULE

	SERVICE AND TEMPERATURES	**INSULATION MATERIAL**	**PIPE SIZES (INCHES)**	**MINIMUM (NOMINAL) INSULATION THICKNESS (INCHES)**
E	Water and other fluids 105 F to140 F.	Flex. Elastomeric Foam or Fibrous Glass	1-1/2 & Less Over 1-1/2	1 2
F	Water and other fluids 141 F to 250 F.	Fibrous Glass	6 & Less 8 & Up	2 2-1/2

3.12 SCHEDULE OF METAL JACKETING FOR INSULATED PIPE

A. Piping Exterior to Building: Jacket insulated piping with circumferentially corrugated aluminum jacketing.
   1. Lap longitudinal and circumferential joints a minimum of 2 inches.
   2. Secure jacketing in place with 1/2 inch x 0.020 inch thick aluminum bands secured with aluminum wing type seals, on maximum 12 inch centers.
   3. Cover insulated fittings, valves, and offsets with mitered sections of jacketing. Seal joints with metal pipe jacket sealant, and secure with aluminum strapping and wing seals.
   4. Factory fabricated, preformed fitting covers of same material as jacketing may be used instead of mitered jacketing.
   5. Install jacketing so as to avoid trapping condensation and precipitation.

END OF SECTION

PART 1 GENERAL

1.01 SUBMITTALS

A. Quality Control Submittals
   1. Test Reports (Field Tests): Submit data for each system tested, and/or disinfected; include date performed, description, and test results for each system.

1.02 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Perform factory testing of factory fabricated equipment in complete accordance with the agencies having jurisdiction.
   2. Perform field testing of piping systems in complete accordance with the local utilities and other agencies having jurisdiction and as specified.

1.03 PROJECT CONDITIONS

A. Protection: During test Work, protect controls, gages and accessories which are not designed to withstand test pressures. Do not utilize permanently installed gages for field testing of systems.

1.04 SEQUENCING AND SCHEDULING

A. Transmit written notification of proposed date and time of operational tests to the Director's Representative at least 5 days in advance of such tests.

B. Perform cleaning and testing Work in the presence of the Director's Representative.

C. Pressure test piping systems inside buildings, at the roughing-in stage of installation, before piping is enclosed by construction Work, and at other times as directed. Perform test operations in sections as required and directed, to progress the Work in a satisfactory manner and not delay the general construction of the building. Valve or cap-off sections of piping to be tested, utilizing valves required to be installed in the permanent piping systems, or temporary valves or caps as required to perform the Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Test Equipment and Instruments: Type and kind as required for the particular system under test.

B. Test Media (air, vacuum, water): As specified for the particular piping or system under test.

C. Cleaning Agent (water): As specified for the particular piping, apparatus or system being cleaned.

PART 3 EXECUTION

3.01 PRELIMINARY WORK

A. Thoroughly clean pipe and tubing prior to installation. During installation, prevent foreign matter from entering systems. Prevent if possible and remove stoppages or obstructions from piping and systems.

3.02 PRESSURE TESTS - PIPING

A. Piping shall be tight under test and shall not show loss in pressure or visible leaks, during test operations or after the minimum duration of time as specified. Remove piping which is not tight under test; remake joints and repeat test until no leaks occur.

B. Water Systems:
   1. Domestic water (potable cold, domestic hot and recirculation) inside buildings:
      a. Before fixtures, faucets, trim and accessories are connected, perform hydrostatic test at 125 psig minimum for 4 hours.
      b. After fixtures, faucets, trim and accessories are connected, perform hydrostatic retest at 75 psig for 4 hours.

C. Gas Piping: Before backfilling or concealment perform air test of duration and pressure as required by the local gas company. However, for gas piping designed for pressures of from 4 inches to 6 inches water column, air test at 15 inches Hg for one hour, without drop in pressure. Test gas piping with air only. Check joints for leaks with soap suds.

D. Air Piping:
   1. Compressed Air: Test with air at 150 psig for one hour.
   2. Check joints for leaks with soap suds.

E. Vacuum Piping: Perform air test at 150 psig for one hour, followed by a vacuum test of 25 inches Hg for one hour, during which time the mercury shall remain stationary for the last 30 minutes of test.

F. Gasoline Piping: As Specified under the Section entitled “Fuel Dispensing System”.

G. Drainage, Vent, Conductor and Roof Drain Piping (Inside Buildings): Perform tests before fixtures are installed. Test by filling the entire system with water, and allowing to stand for 3 hours, with no noticeable loss of water. Test joints under a minimum head of 10 feet of water, except the uppermost section. Test the uppermost section to overflowing.

3.03 TESTING OF EQUIPMENT, APPARATUS AND APPURTENANCES

A. Relief Valves: Increase pressure in equipment or apparatus to relief valve setting, to test opening of valves at required relief pressures.

3.04 DISINFECTION OF POTABLE WATER SYSTEMS

A. Disinfect potable water pipe and equipment installed in the Work of this Contract.
   1. Completely fill the piping, including water storage equipment if installed, with a water solution containing 50 mg/L available chlorine, and allow stand for 24 hours. Operate all valves during this period to assure their proper disinfection.
   2. After the retention period, discharge the solution to an approved waste and flush the system thoroughly with water until substantially all traces of chlorine are removed. Drain and flush water storage equipment if installed.

B. Connect plumbing fixtures and equipment and place the system into service. Prevent recontamination of the piping during this phase of the Work.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Domestic water piping and fittings

B. Domestic water plastic piping and fittings

C. Natural gas piping and fittings

D. Sanitary and storm piping and fittings

E. Sanitary piping and fittings for acid waste applications

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Through Penetration Firestops: Section 078400.

B. Sealants: Section 079200.

1.03 SUBMITTALS

A. Product Data:
   1. Catalog sheets and specifications indicating manufacturer name, type, applicable reference standard, schedule, or class for specified pipe and fittings.
   2. Material Schedule: Itemize pipe and fitting materials for each specified application in Pipe and Fittings Schedule in Part 3 of this Section. Where optional materials are specified indicate option selected.

B. Quality Control Submittals
   1. Copy of hydraulic press fitting manufacturer's printed field inspection procedures for hydraulic press joints in domestic tubing.

PART 2 PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Steel Pipe for Threading: Standard weight, Schedule 40, black or galvanized; ASTM A 53 or ASTM A 135.

B. Malleable Iron, Steam Pattern Threaded Fittings:
   1. 150 lb Class: ASME B16.3.
   2. 300 lb Class: ASME B16.3.

C. Cast Iron Fittings:
   1. Drainage Pattern, Threaded: ASME B16.12.
   2. Steam Pattern, Threaded: ASME B16.4.
      a. Standard Weight: Class 125.
      b. Extra Heavy Weight: Class 250.

D. Unions: Malleable iron, 250 lb class, brass to iron or brass to brass seats.

E. Couplings: Same material and pressure rating as adjoining pipe, conforming to standards for fittings in such pipe. Use taper tapped threaded type in screwed pipe systems operating in excess of 15 psig.

F. Nipples: Same material and strength as adjoining pipe, except nipples having a length of less than one inch between threads shall be extra heavy.

2.02 COPPER AND BRASS PIPE, TUBING AND FITTINGS

A. Copper Tube, Types K, L, and M: ASTM B 88.

B. Wrot Copper Tube Fittings, Solder Joint: ASME B16.22.

C. Cast Copper Alloy Tube Fittings, Solder Joint: ASME B16.18.

D. Drainage Tube, Type DWV: ASTM B 306.

E. Wrot Copper Drainage Tube Fittings, Solder Joint: ASME B16.29.

F. Cast Copper Alloy Drainage Fittings, Solder Joint: ASME B16.23.

G. Unions: Cast bronze, 150 lb Class, bronze to bronze seats, threaded or solder joint.

H. Plumber's Tube: Seamless, semi-annealed, minimum 65 percent copper, No. 18 B & S Gage.

I. Flared Tube Fittings:
   1. Water Tube Type: ASME B16.26.

J. Flanges: Conform to the Standards for fittings used in systems.
   1. Brazing Flanges: ASME B16.24, hubs modified for brazing ends.

2.03 HYDRAULIC PRESS FITTINGS FOR COPPER TUBING

A. Acceptable Fittings:
   1. ProPress by Viega, 301 N. Main, Wichita, KS 67202, (877) 843-4262, www.viega.com.
   2. Operating Conditions:
      a. Maximum Operating Pressure: 200 psi.
      b. Operating Temperature Range: 0-250 degrees F.
      c. Maximum Test Pressure: 600 psi.
      d. Maximum Vacuum: 29.2 inches hg @ 68 degrees F.
   3. Features:
      a. Fittings: Copper and copper alloy conforming to material requirements of ASME B16.18 or ASME B16.22.
         1) Stainless Steel Grip Ring: Adds strength to the joint without collapsing the interior passageway
      b. No flame for soldering required for installation of fittings and valves.
      c. Unpressed connections identified during pressure testing when water flows past sealing element.
      d. Sealing Elements: Factory installed, EPDM.
      e. Fittings that have been pressed can be rotated. If rotated more than 5 degrees, the fitting must be repressed to restore its resistance to rotational movement.
      f. Extended fitting end lead allows for twice the retention grip surface, and assists with proper tube alignment.
      g. Soldered adapter fittings are not allowed.

2.04 CAST IRON PIPE AND FITTINGS

A. Bell and Spigot Soil Pipe: Service Weight, Bitumin coated; ASTM A 74.

B. Bell and Spigot Soil Pipe Fittings: Service Weight, Bitumin coated; ASTM A 74.

C. Hubless Pipe: Bitumin coated; Cast Iron Soil Pipe Institute Standard No. 301.

D. Hubless Pipe Fittings: Drainage Pattern, Bitumin coated; Cast Iron Soil Pipe Institute Standard No. 301.

E. Hubless Joint Couplings: Stainless steel shield and clamp assembly, and elastomer sealing sleeve; CISPI-310.

F. Water Pipe Fittings: Bitumin coated, cement-mortar lined; AWWA C110.

2.05 DUCTILE IRON PIPE AND FITTINGS

A. Water Pipe: Bitumin coated and cement-mortar lined; AWWA C151.
   1. 3 and 4 Inch Sizes: Class 51.
   2. 6 inch Size and Over: Class 50.

B. Fittings: Bitumin coated and cement-mortar lined; AWWA C110.

2.06 COUPLINGS AND FITTINGS FOR GROOVED END PIPE

A. Couplings: Grinnell Corp.'s Rigidlok Fig. 7401, or Victaulic Co.'s Style 107, having minimum pressure rating of:
   1. 750 psi from 1-1/2 inch to 4 inch.
   2. 700 psi for 6 inch.
   3. 600 psi for 8 inch.
   4. Couplings: Gustin-Bacon Inc.'s No. 100 Gruvagrips, or Victaulic Co.'s Style 77, having pressure rating of:
      a. 1000 psi for 3/4 inch to 6 inch.
      b. 800 psi for 8 inch to 12 inch.
      c. 300 psi for 14 inch to 24 inch.
   5. Fittings: By same manufacturer as couplings, having pressure ratings equal to or greater than couplings. Comply with the following standards:
      a. Steel: ASTM A 53 or A 106, Grade B.
      b. Malleable Iron: ASTM A 47.
      c. Ductile Iron: ASTM A 536.

2.07 ACID WASTE PIPE, FITTINGS AND COUPLINGS

A. Glass Drainline Piping: Tempered and annealed borosilicate glass pipe and fittings, FS DD-G-541A; Schott Process Systems, Inc., 1640 S.W. Boulevard, Vineland, NJ 08360, or QVF Process Systems, Inc., 35 West William St., Corning, NY 14830.
   1. Drainline Couplings: Compression type; comprised of a stainless steel outer shell and bolting assembly, a Buna-N Rubber Compression liner, and a seal ring gasket of tetra-fluoro-ethylene; Schott Process Systems or QVF Process Systems.
   2. High Silicon Cast Iron Pipe and Fittings: Acid resistant cast iron bell and spigot pipe and fittings, containing not less than 14 percent silicon.

2.08 JOINING AND SEALANT MATERIALS

A. Thread Sealant:
   1. LA-CO Industries', Slic-Tite Paste with Teflon.
   2. Loctite Corp.'s No. 565 Thread Sealant.
   3. Thread sealants for potable water shall be NSF approved.

B. Thread Sealant (Natural Gas Piping): Rectorseal Corp.'s T Plus 2 non-hardening pipe dope with teflon.

C. Solder: Solid wire type conforming to the following:
   1. Type 3: Lead-free tin-silver solder (ASTM B 32 Alloy Grade E, AC, or HB); Engelhard Corp.'s Silvabrite 100, Federated Fry Metals' Aqua Clean, or J.W. Harris Co. Inc.'s Stay-Safe Bridgit.

D. Soldering Flux for Soldered Joints: All-State Welding Products Inc.'s Duzall, Engelhard Corp.'s General Purpose Liquid or Paste, Federated Fry Metals' Water Flow 2000, or J.W. Harris Co. Inc.'s Stay-Clean.

E. Lead for Calking Joints in Cast Iron Soil Pipe: ASTM B 29 for pig lead.

F. Joint Packing:
   1. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc., 931 Daniel St., Kenner, LA 70062, (504) 466-1484.
   2. Acid Resistant Joint Packing: Sealite Inc.'s Red Stripe, Asbestos-Free Acid-Resistant White Oakum, No. 312.

G. Gaskets For Use With Ductile Iron Water Pipe and Cast Iron Drainage Pipe: Synthetic rubber rings (molded or tubular): Clow Corp.'s Belltite, Tyler Pipe Industries Inc.'s Ty-Seal, or U.S. Pipe and Foundry Co.'s Tyton.

H. Flange Gasket Material:
   1. For Use with Cold Water: 1/16 inch thick rubber.
   2. For Use with Hot Water, or Air : Waterproofed non-asbestos ceramic or mineral fiber, or a combination of metal and water-proofed non-asbestos ceramic or mineral fiber, designed for the temperatures and pressures of the piping systems in which installed.

I. Gaskets For Use With Grooved End Pipes and Fittings: Type and materials as recommended and furnished by the fitting manufacturer, for the service of piping system in which installed.

J. Anti-Seize Lubricant: Bostik Inc.'s Never Seez or Dow Corning Corp.'s Molykote 1000.

2.09 PACKING MATERIALS FOR BUILDING CONSTRUCTION PENETRATIONS

A. Oiled Oakum: Manufactured by Nupak of New Orleans, Inc., 931 Daniel St., Kenner, LA 70062, (504)466-1484.

2.10 DIELECTRIC CONNECTORS

A. Dielectric Fitting: Bronze ball valve with end connections and pressure rating to match associated piping.
   1. Nipples with inert non-corrosive thermoplastic linings are not acceptable.
   2. Flange Electrical Insulation Kit: Consisting of dielectric sleeves and washers, and dielectric gasket.
      a. Rated 150 psi at 250 degrees F: ANSI Class 150, full faced neoprene gasket with bolt holes, double phenolic washers, and mylar sleeves; Model 150 by APS, Lafayette, LA 70596, (337) 233-6116.

2.11 PIPE SLEEVES

A. Type A: Schedule 40 steel pipe.

B. Type B: No. 16 gage galvanized sheet steel.

C. Type C: Schedule 40 steel pipe with 1/4 inch steel collar continuously welded to pipe sleeve. Size steel collars as required to span a minimum of one cell or corrugation, on all sides of the rough opening thru the metal deck.

D. Type D: No. 16 gage galvanized sheet steel with 16 gage sheet steel metal collar rigidly secured to sleeve. Size metal collars as required to span a minimum of one cell or corrugation, on all sides of the rough opening thru the metal deck.

2.12 FLOOR, WALL AND CEILING PLATES

A. Cast Brass: Solid type with polished chrome plated finish, and set screw.
   1. Series Z89 by Zurn, 929 Riverside Drive, Grosvenordale, CT 06255, (800) 243-1830.
   2. Model 127XXXX by Maguire Mfg., Cheshire CT 06410, (203) 699-1801.
   3. Stamped Steel: Split type, polished chrome plated finish, with set screw.
      a. Figures 2 and 13 by Anvil International, Portsmouth, NH 03802, (603) 422-8000.
   4. Cast Iron or Malleable Iron: Solid type, galvanized finish, with set screw:
      a. Model 395 by Anvil International, Portsmouth, NH 03802, (603) 422-8000.
      b. Model 900-016XX by Landsdale International, Westville, NJ 08093, (800) 908-0523.

2.13 FLEXIBLE CONNECTIONS

A. Underground Application:
   1. Acceptable Companies:
      a. Titeflex Inc., Springfield, MA.
      b. Flex-ing, Sherman, TX.
   2. Features:
      a. Construction: Stainless steel innercore covered with braided Type 304 stainless steel outer jacket.
      b. UL listed for underground fuel storage tank systems.
      c. Permanently crimped stainless steel collars with one threaded end and one threaded swivel end.

B. Underground or Above Ground Application:
   1. Acceptable Companies:
      a. Titeflex Inc., Springfield, MA.
      b. Flex-ing, Sherman, TX.
   2. Features:
      a. Construction: Convoluted, Type 321 stainless steel inner core, minimum .012 inch wall thickness covered with braided Type 304 stainless steel outer jacket.
      b. UL listed for above ground and underground use.
      c. Factory installed male swivel on one end.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install piping at approximate locations indicated, and at maximum height.

B. Install piping clear of door swings, and above sash heads.

C. Make allowances for expansion and contraction.

D. Allow for a minimum of one inch free air space around pipe or pipe covering, unless otherwise specified.

E. Install horizontal piping with a constant pitch, and without sags or humps.
   1. Water Piping: Pitch 1/4 inch per 10 feet upward in direction of flow, unless otherwise noted. If it is not possible to maintain constant pitch, establish a new low point and continue. At the low point, provide a 1/2 inch drip leg and gate valve with a hose bibb end. Provide an air vent at the high point.
   2. Drainage Piping: Pitch 1/4 inch per foot downward, in direction of flow, unless otherwise noted.
   3. Vent Piping: Pitch 1/4 inch per foot upward, unless otherwise noted.

F. Install vertical piping plumb.

G. Use fittings for offsets and direction changes, except for Type K soft annealed copper temper water tube.

H. Cut pipe and tubing ends square; ream before joining.

I. Threading: Use American Standard Taper Pipe Thread Dies.
   1. Thread brass pipe with special brass threading dies.

3.02 DRAINAGE SYSTEMS

A. Fittings:
   1. Use long turn drainage pattern fittings, unless space conditions prohibit their use; in such cases, short turn pattern fittings may be used.
   2. Vertical Offsets: Make vertical offsets with 45 degree elbows, or 1/8 bends.
   3. Tucker Fittings: Tucker fittings may only be installed in vertical piping.

B. Cleanouts:
   1. Install cleanouts with sufficient side and end clearance to allow for the removal of the cleanout plug, and the use of cleaning tools.
   2. Lubricate cleanout plugs with anti-seize lubricant.

3.03 DOMESTIC WATER PIPING SYSTEM

A. Connect runouts to the upper quadrant of the main, and run upward at not less than 45 degrees before extending laterally.

B. Make final connections to plumbing fixtures and equipment with unions, or flanges:
   1. Do not use unions in ferrous piping larger than 3 inches.
   2. Do not use unions in brass or copper piping larger than 2 inches.

3.04 NATURAL GAS PIPING SYSTEM

A. Install gas piping system in conformance with the National Fuel Gas Code, NFPA 54, or as required by the serving gas supplier.

B. Use non-hardening pipe dope on threads. Do not use thread seal tape.

3.05 PIPE JOINT MAKE-UP

A. Threaded Joint: Make up joint with a pipe thread compound applied in accordance with manufacturer’s printed application instructions for the intended service.

1. Chrome Plated Brass Pipe: Tighten joint with a strap or Parmalee wrench; do not mar pipe finish. Install piping so that no threads are visible.

B. Soldered Joint: Thoroughly clean tube end and inside of fitting with emery cloth, sand cloth, or wire brush. Apply flux to the pre-cleaned surfaces. Install fitting, heat to soldering temperature, and join the metals with type solder specified. Remove residue.

C. Flanged Pipe Joint:
   1. Install threaded companion flanges on steel pipe; flanges on galvanized pipe are not required to be galvanized.
   2. Provide a gasket for each joint.
      a. Hot Water Pipe Gasket: Coat with a thin film of oil before making up joint.
      b. Air Pipe Gasket: Coat with a thin film of oil before making up joint.
   3. Coat bolt threads and nuts with anti-seize lubricant before making up joint.

D. Calked Joint: Pack hub with joint packing specified, and calk. Run 12 ounces molten lead for each inch of pipe diameter. Calk cooled lead ring and face off smoothly.

E. Rubber Ring Push-on Joint: Clean hub, bevel spigot, and make up joint with lubricated gasket in conformance with the manufacturer's printed installation instructions.

F. Grooved Pipe Joint: Roll groove pipe ends, make up joint with grooved end fittings and couplings, in conformance with the manufacturer's printed installation instructions.
   1. Cut grooved end piping is not acceptable.

G. Hubless CI Pipe Joint: Make up joint with hubless fitting and couplings, in conformance with the manufacturer's printed installation instructions.

H. Mechanical Joint: Make up joint in conformance with the manufacturer's printed installation instructions, with particular reference to tightening of bolts.

I. Glass Pipe Joint: Make up joint with glass drainline fittings and couplings in conformance with the manufacturer's printed installation instructions.

J. Polyethylene Containment Pipe Joint: Follow manufacturer's printed installation instructions.

K. High Density Polyethylene Pipe Joint (HDPE): Follow manufacturer's printed installation instructions.

L. Hydraulic Pressed Joint: Follow manufacturer's printed installation instructions.

M. Dissimilar Pipe Joint:
   1. Joining Bell and Spigot and Threaded Pipe: Install a half coupling on the pipe or tube end to form a spigot, and calk into the cast iron bell.
   2. Joining Dissimilar Threaded Piping: Make up connection with a threaded coupling or with companion flanges.
   3. Joining Dissimilar Non-Threaded Piping: Make up connection with adapters recommended by the manufacturers of the piping to be joined.
   4. Joining Galvanized Steel Pipe and Copper Tubing: Make up connection with a dielectric connector.
   5. Joining FRP and Threaded Pipe: Make up connection with adapters as recommended by manufacturers of piping being joined.

3.06 PIPING PENETRATIONS

A. Sleeve Schedule: Unless otherwise shown, comply with the following schedule for the type of sleeve to be used where piping penetrates wall or floor construction:

	CONSTRUCTION	SLEEVE TYPE
a.	Frame construction.	None Required
b.	Foundation walls.	A*
c.	Non-waterproof interior walls.	B*
d.	Non-waterproof interior floors on metal decks.	D*
e.	Non-waterproof interior floors not on metal decks.	B*
f.	Floors not on grade having a floor drain.	A
g.	Floors over mechanical equipment, steam service, machine, and boiler rooms.	A
h.	Floors finished or to be finished with latex composition or terrazzo, and on metal decks.	D*
i.	Floors finished or to be finished with latex composition or terrazzo, and not on metal decks.	A
j.	Earth supported concrete floors.	None Required
k.	Exterior concrete slabs on grade.	A
l.	Fixtures with floor outlet waste piping.	None Required
m.	Metal roof decks.	C
n.	Non-metal roof decks.	A
o.	Waterproof floors on metal decks.	D
p.	Waterproof floors not on metal decks.	A
q.	Waterproof walls.	A

*Core drilling is permissible in lieu of sleeves where marked with asterisks.

B. Diameter of Sleeves and Core Drilled Holes:
   1. Unless otherwise specified, size holes thru floors and walls in accordance with the through penetration fire stopping system being used.
   2. Size holes thru exterior walls or waterproofed walls above inside earth or finished floors, and exterior concrete slabs in accordance with the following:
      a. Uninsulated (Bare) Pipe: Inside diameter of sleeve or core drilled hole 1/2 inch greater than outside diameter of pipe, unless otherwise specified.
      b. Insulated Pipe: Inside diameter of sleeve or core drilled hole 1/2 inch greater than outside diameter of insulation, unless otherwise specified.
      c. Mechanical Modular Seals: Size holes in accordance with the manufacturer's recommendations.
   3. Size holes for sprinkler and fire standpipe piping in accordance with NFPA 13.

C. Length of Sleeves (except as shown otherwise on Drawings):
   1. Walls and Partitions: Equal in length to total finished thickness of wall or partition.
   2. Floors with Finish: Equal in length to total finished thickness of floor and extending 1/2 inch above the finished floor level, except as follows:
      a. In furred spaces at exterior walls, extend sleeve one inch above the finished floor level.
   3. Exterior Concrete Slabs: Equal in length to total thickness of slab and extending 1/2 inch above the concrete slab.

4. Roofs: Equal in length to the total thickness of roof construction, including insulation and roofing materials, and extending one inch above the finished roof level.

D. Packing of Sleeves and Core Drilled Holes:
   1. Unless otherwise specified, pack sleeves or cored drilled holes in accordance with Section 078400 - FIRESTOPPING.
   2. Pack sleeves in exterior walls or waterproofed walls above inside earth or finished floors with oakum to within 1/2 inch of each wall face, and finish both sides with Type 1C (one part) sealant. See Section 079200.
      a. Mechanical modular seals may be used in lieu of packing and sealant for sleeves and core drilled holes.
   3. Pack sleeves in exterior concrete slabs with oakum to full depth, and within 1/2 inch of top of sleeve and finish the remainder with sealant. See Section 079200.
      a. Sealant Types:
         1) Piping Conveying Materials up to 140 degrees F other than Motor Fuel Dispensing System Piping: Type 1C (one part).
      b. Mechanical modular seals may be used in lieu of packing and sealant for sleeves and core drilled holes.

E. Weld metal collars of Type C and D sleeves to the upper surface of the metal deck. Seal voids under the metal collar as recommended by the manufacturer of the metal deck.

3.07 FLOOR, WALL AND CEILING PLATES

A. Install plates for exposed uninsulated piping passing thru floors, walls, ceilings, and exterior concrete slabs as follows:
   1. In Finished Spaces:
      a. Piping 4 Inch Size and Smaller: Solid or split, chrome plated cast brass.
      b. Piping Over 4 Inch Size: Split, chrome plated cast brass.
      c. Unfinished Spaces (Including Exterior Concrete Slabs): Solid, unplated cast iron.
      d. Fasten plates with set screws.
      e. Plates are not required in pipe shafts or furred spaces.

3.08 PIPE AND FITTING SCHEDULE

A. Where options are given, choose only one option for each piping service. No deviations from the selected option will be allowed.

B. Acid Waste (Above Ground):
   1. Glass drainline pipe, fittings and couplings.
   2. High silicon cast iron bell and spigot pipe and fittings, with joints calked with lead and acid resistant joint packing.

C. Acid Waste (Below Ground): High silicon cast iron bell and spigot pipe and fittings, with joints calked with lead and acid resistant joint packing.

D. Domestic Water (Above Ground):
   1. 3 inch and Under: Type L hard drawn copper tube, with cast copper alloy or wrot copper solder type fittings, and joints made up with Type 3 solder, or hydraulic press joints.
   2. 4 inch and Over: Coated ductile iron water pipe and fittings, with mechanical or push-on joints installed as per manufacturer’s instructions.

E. Domestic Water:
   1. 2 inch and Under: Crosslinked polyethylene (PEX) tubing PEX-A method with Mechanical or Push-fit joints. Install as per Manufacturer’s recommendation.

2. 2-1/2” inch and Over: Chlorinated Polyvinyl Chloride (CPVC) plastic piping with Mechanical Joints, Solvent Cementing, or Push-fit Joints installed as per manufacturer’s instructions.

F. Domestic Water (Below Ground):
   1. 2-1/2 inches and Under: Type K soft annealed copper tube with water tube type flared fittings.
   2. 3 inches and Over: Coated ductile iron water pipe and fittings, with mechanical or push-on joints.

G. Drainage (Sanitary) Above Ground:
   1. Service weight, coated, cast iron bell and spigot pipe and fittings with calked joints.
   2. Service weight, coated, cast iron bell and spigot pipe and fittings with rubber ring push-on joints.
   3. Hubless, coated, cast iron pipe, fittings, and joint couplings.
   4. DWV copper tubing, with cast brass or wrot copper drainage pattern fittings, and joints made with Type 3 solder.

H. Drainage (Storm) Above Ground:
   1. Service weight, coated, cast iron bell and spigot pipe and fittings, with calked joints.
   2. Service weight, coated, cast iron bell and spigot pipe and fittings, with rubber ring push-on joints.
   3. Hubless, coated, cast iron pipe, fittings and joint couplings.
   4. DWV copper drainage tube, with cast copper alloy or wrot copper drainage pattern fittings, and joints made up with Type 3 solder.

I. Drainage Piping (Below Ground):
   1. Option No. 1: Service weight, coated, cast iron bell and spigot pipe and fittings, with calked joints.
   2. Option No. 2: Service weight, coated, cast iron bell and spigot pipe and fittings, with rubber ring push-on joints.

J. Natural Gas Piping including associated vent:
   1. Inside Building: Standard weight black steel pipe, with 150 lb malleable iron fittings, and threaded joints.

K. Vent Piping: Same materials that are used for piping system to which vent is connected.

END OF SECTION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Air Gap Fittings: Section 220576.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog cuts, specifications and installation instructions for each type Vacuum Breaker.
   2. Manufacturer's printed test procedure for testing operation of pressure type vacuum breaker.

1.03 MAINTENANCE

A. Special Tools: One for each type and size vandal resistant fastener.

PART 2 PRODUCTS

2.01 VACUUM BREAKERS

A. Type B: Atmospheric vacuum breaker conforming to ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
   1. Non-pressure type with polished chrome plated brass body, disc float, silicone disc, bronze internal trim and maximum working conditions of 125 psi and 210 degrees F.
      a. Operation: Internal disc float drops, closes orifice, and opens atmospheric vent upon back siphonage.
      b. Connections: Female threaded inlet and outlet.

B. Type C: Hose bibb vacuum breaker conforming to ASSE 1011 - Hose Connection Vacuum Breakers.
   1. Frost resistant type with brass body, flat poppet type check valve, rubber disc and mating part, bronze internal trim, drainage feature, and breakaway screw or vandal resistant fastener.
      a. Operation: Check valve closes orifice and opens atmospheric vent upon back siphonage.
      b. Connections: 3/4 inch female hose thread inlet, and 3/4 inch hose bibb outlet.

C. Type D: Pressure type vacuum breaker conforming to ASSE 1020 - Vacuum Breakers, Anti-Siphon, Pressure Type.
   1. Chrome plated bronze body with spring loaded disc float and check valve; bronze internal trim, silicone rubber discs, stainless steel hood, gate valve on inlet and outlet, 2 test cocks, and maximum working conditions of 150 psi and 210 degrees F.
      a. Operation: Internal disc float opens atmospheric vent and check valve closes inlet when line pressure drops to one psi or below.
      b. Connections: Female threaded inlet and outlet.

D. Type E: Handspray vacuum breaker, conforming to ASSE 1011 - Hose Connection Vacuum Breakers.
   1. Polished chrome plated, brass body with flat poppet type check valve, rubber disc and mating part, bronze internal trim, and conforming to ASSE 1011 - Hose Connection Vacuum Breakers.
      a. Operation: Check valve closes orifice and opens atmospheric vent upon back siphonage.
      b. Connections: 1/2 inch female threaded inlet, and 1/2 inch male threaded outlet.

2.02 FASTENERS

A. Vandal Resistant: Allen or spanner head bolts. Phillips head and slotted head fasteners are not acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

3.02 FIELD QUALITY CONTROL

A. Operation Test:
   1. Check vacuum breaker for leaking under normal operating conditions.
   2. Apply negative pressure to the vacuum breaker inlet, and observe that the device opens to the atmosphere.
   3. Type D Vacuum Breaker: Test the device in accordance with the manufacturer's printed test procedure.
   4. Repair or replace any device failing the operation test, and retest.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Reduced pressure zone principle device

B. Double check valve device

C. Atmospheric vent

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog sheets, specifications, and installation instructions for each type backflow preventer and test kit.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with the State Department of Health Sanitary Code for Cross Connection Control, and the other standards listed in Part 2 of this section.
   2. Where conflicts occur between the referenced standards, the most stringent requirements shall apply.

1.04 MAINTENANCE

A. Special Tools (as furnished or recommended by the backflow preventer manufacturer). Deliver to the Building Owner:
   1. Test Kit A: Portable, packaged in a substantially built, compartmented carrying case, containing hose, gauge, and fittings required for testing backflow preventer for proper operation, and printed procedure for conducting test.
   2. Test Kit B: Sight tube, of required length, for testing backflow preventer for proper operation, and printed procedure for conducting test.

PART 2 PRODUCTS

2.01 BACKFLOW PREVENTERS

A. Type A: Reduced Pressure Zone Principle device, with atmospheric vent, conforming to ASSE Standard 1013, AWWA C-511, USC specifications manual for Cross Connection Control, and listed as acceptable in the State Department of Health, Environmental Health Manual.
   1. Performance: 150 psig, and 130 degrees F maximum working conditions.
   2. Assembly: Strainer and gate valve on inlet side, gate valve on outlet side, and four test cocks, all as furnished or recommended by the backflow preventer manufacturer.
   3. Acceptable Manufacturer's: Watts, Zurn Wilkins, Febco

B. Type B: Double Check Valve device, conforming to ASSE Standard 1015, AWWA C-510, USC specifications manual for Cross Connection control, and listed as acceptable in the New York State Department of Health, Environmental Health manual.
   1. Performance: 150 psig, and 130 degrees F, maximum working conditions.
   2. Assembly: Strainer and gate valve on inlet side, gate valve on outlet side, and four test cocks, all as furnished or recommended by the backflow preventer manufacturer.
   3. Acceptable Manufacturer's: Watts, Zurn Wilkins, Febco

C. Type C: Atmospheric vent, conforming to ASSE 1012.
   1. Performance: 175 psig and 210 degrees F maximum working conditions.

2. Assembly: Internal strainer, and union connections.
3. Acceptable Manufacturer's: Watts, Zurn Wilkins, Febco

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions.

B. Atmospheric Vent: Pipe vent to spill over closest point of drainage, as directed, maintaining a minimum 12 inch air gap above the drain.
   1. Install air gap fitting when shown, or if atmospheric vent must be connected to drainage line. See Section 220576.

3.02 FIELD QUALITY CONTROL

A. Operation Test: Test kit as specified under Part 1 of this section may be used. Conduct test in the presence of the Director's Representative.
   1. Type A Backflow Preventer: Test the device with the test kit in accordance with the manufacturer's test procedures.
   2. Type B Backflow Preventer: Test the device with the test kit in accordance with the manufacturer's test procedure.
   3. Type C Backflow Preventer: Test at 125 psi hydrostatic pressure, and hold for four hours; check for leaking.

B. Re-testing: Repair or replace any device failing the operation test, and repeat the test.

END OF SECTION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Showers: Section 224223.

1.02 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each type of mixing valve.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements: Unless otherwise shown or specified, comply with the applicable requirements of FS WW-P-541.

PART 2 PRODUCTS

2.01 VALVES - GENERAL

A. Valve Body: Cast brass.

B. Internal Components:
   1. Metals: Brass, or stainless steel.
   2. Non-Metals: Materials not adversely affected by contact with water, temperature changes, and normal wear.

C. Finishes: Furnish polished, chrome plated brass, or No. 4 brush finished stainless steel on exposed to view surfaces installed in finished spaces.

D. Single Handle Mixing Valves:
   1. Operation: Valve shuts off in full cold position, and must pass through cold range before delivering warm, and/or hot water.
   2. Temperature Limit Stop: Factory set for 105 degrees F maximum delivery temperature.
   3. Automatic Shut-Down: If one supply should fail, the other will automatically and instantly shut down.

2.02 VALVE TYPES

A. Type A: Thermostatically operated by means of bi-metallic strip, or expansion bellows.
   1. Accessories: Combination stop, check and removable strainer.
   2. Temperature Range: Cold through 115 degrees F.

B. Type B: Single handle mechanical mixer, or individual hot and cold control valves.
   1. Individual Control Valves: Fit with four-arm indexed metal handles, which turn counter to each other for on and off positions.

C. Type C: Pressure balancing shower valve.
   1. Accessories: Integral stops.
   2. Accessories: Integral stop-check valves.
   3. Temperature Range: Cold through 115 degrees F.
   4. Delivery Capacity: 5 gpm at 45 psi differential.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions.

3.02 FIELD QUALITY CONTROL

A. Capacity Check: Operate valve through entire range, and verify rated capacity. Correct discrepancies.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Thermometers

B. Pressure and compound gagues

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Valves: Section 220523.

B. Pumps: Section 221123.

1.03 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications and installation instructions for each item specified.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Where Federal, NSF, ASME or other standards are indicated or required, products shall meet or exceed the standards established for material, quality, manufacture and performance.

PART 2 PRODUCTS

2.01 MANUFACTURERS/COMPANIES

A. Dresser Instruments.

B. Marsh Bellofram.

C. Moeller Instrument Co.

D. Taylor Precision Products.

E. H.O. Trerice Co.

F. Weksler Instruments Corp.

2.02 THERMOMETERS

A. General Design Features:
   1. Scale Ranges: 1-1/2 times actual working temperature required for the particular application, as approved.
      a. Maximum of two degrees between graduations and ten degrees between numerals.
      b. When scale ranges are in excess of 100 degrees, maximum range between numerals may be 20 degrees, or as otherwise approved for the particular application.
   2. Direct Reading Thermometers: Bimetallic actuated, dial type, straight pattern, angle pattern, or adjustable angle pattern as required.
   3. Remote Reading Thermometers: Vapor tension actuated, or gas actuated type, with extension capillary tube of length as required for the particular application.
      a. Case type as required for the particular mounting application.
   4. Thermometers for Sensing Liquid Temperature: Furnish with separable sockets.

a. Sockets for Use in Insulated Piping, Insulated Tanks or Similar Equipment: Extension lagging neck type, of length as required to compensate for insulation thickness, and proper immersion..

2.03 PRESSURE AND COMPOUND GAUGES

A. Type: Adjustable dial type with micrometer type pointer, or external calibration device, bronze bourdon tube, and bronze bushed rotary movement.

B. Dial: White enameled background, and bold black graduations, numerals and pointer; 3-1/2 inch diameter.
   1. Scale Range:
      a. Standard Gauges: Double normal operating pressure.
      b. Compound Gauges: From 30" Hg vacuum to double normal operating pressure.

C. Case: Cast aluminum, brass, or black finished phenolic.

D. Accuracy: Guaranteed of within 1 percent in middle third of dial range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Thermometers:
   1. Install in accordance with the manufacturer's printed installation instructions.
   2. Install direct reading thermometers, when the application requires installation 6 feet or less above the floor or bottom of space in which installed, and remote reading type when the installation is over 6 feet.

B. Pressure and Vacuum Gauges:
   1. Install in accordance with the manufacturer's printed installation instructions.
   2. For measuring liquid pressure, install gauges complete with stop cocks and drain cocks.

C. Pressure Snubbers and Impulse Dampers:
   1. Install pressure snubbers in the piping connections to gauges installed in suction and discharge piping connections to close coupled and base mounted circulating pumps driven by motors under 10 HP.
   2. Install impulse dampers in the piping connections to gauges installed in suction and discharge piping connections to close coupled and base mounted circulating pumps driven by motors 10 HP and over.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. General pump requirements

B. Requirements for circulating water pumps

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Wiring for Motors and Motor Controllers: Section 260523.

B. Motors and Motor Controllers: Section 260221.

1.03 SUBMITTALS

A. Product Data: Catalog sheets and installation instructions for each type or size pump.

B. Schedule: Pump schedule showing pump specifications and application.

C. Quality Control Submittals:
1. Performance curves for each pump, showing gpm, brake HP and efficiency from free delivery to shut-off. Chart curves on manufacturer's factory tests shall be conducted in accordance with the recommended procedures of the Hydraulic Institute, and certified thereto by the manufacturer.

D. Contract Close Out Submittals:
1. Operation, Maintenance Data, and Parts Lists: Deliver 2 copies, for each type of pump or pumping apparatus, to the Director's Representative.

1.04 MAINTENANCE

A. Spare Parts: Deliver one spare set of mechanical seals for each size and type of pump equipped with mechanical seals, to the Director's Representative, who will sign receipt for same. Furnish seals of type as required for the particular pump application and the chemical water treatment being utilized. Suitably box and label spare seals as to their usage.

PART 2 PRODUCTS

2.01 PUMPS - GENERAL

A. Design pumps to operate continuously without overheating bearings or motors at every condition of operation on the pump curve, or produce noise audible outside the room or space in which installed.

B. Equip pumps complete with electric motor and drive assembly, unless otherwise indicated. Design pump casings for the indicated working pressure and factory test at 1-1/2 times the designed pressure.

C. Manufacture domestic hot water pumps of all-bronze construction.

D. Pumps of the same type, shall be the product of a single manufacturer, with pump parts of the same size and type interchangeable.

2.02 CIRCULATING WATER PUMPS

A. In-Line Pump: Single stage volute type pump, with Bronze impeller, replaceable mechanical seals, oil lubricated shaft sleeve bearings, and cast iron casing with flanged inlet and outlet connections. Direct connect pump to electric motor with flexible coupling.
   1. Motor Requirements (Supplementary to Section 260221):
   2. Equip motor with built-in thermal overload protection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in-line circulating pumps between pipe flanges in piping systems. Install overhead pipe supports, both sides of in-line pumps, installed in horizontal piping runs.

B. Timer and aquastat to be wired to the Circulating Pump for Building Owner flexibility.

END OF SECTION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Valves: Section 220523.

B. Cleaning and Testing: Section 220800.

C. Plumbing Piping: Section 221100.

1.02 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each type strainer.

PART 2 PRODUCTS

2.01 STRAINERS

A. Body:
   1. Type:
      a. Y.
      b. Simplex basket.
      c. Duplex basket.
   2. Materials: Either of the following:
      a. ASTM A 126 Grade B cast iron.
      b. ASTM A 216 WCB cast steel.
      c. ASTM B 62 cast bronze may be used in systems operating at a maximum of 125 psig steam or 175 psig water.

B. Pressure Ratings:
   1. 125 psig WSP, 175 psig WOG.
   2. 250 psig WSP, 400 psig WOG.

C. End Connections:
   1. Threaded ends for use in threaded piping 3 inch size and smaller.
   2. Flanged ends in piping 4 inch size and larger.
   3. Solder ends or threaded ends with solder adapters in copper tubing.

D. Screens/Baskets: Fabricate from 18-8 stainless steel or monel metal.
   1. Perforation Sizes:
      a. Water Piping:
         1) 3 inch and Smaller: 1/16 inch perforations.
         2) Over 3 inch: 1/8 inch perforations.
   2. Minimum Free Screen/Basket Area: Double the internal cross sectional area of the inlet pipe.

E. Caps and Covers:
   1. Strainers 3 inch size and Smaller: Either of the following:
      a. Faced and gasketed screen retaining cap.
      b. Straight thread bushing with a blow-out proof gasket.
      c. Internally milled tapered gasketed bushing.
   2. Strainers 4 inch size and Larger: Bolted gasketed screen cover.
   3. Gasket Material: Graphited non-asbestos mineral or ceramic fiber.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide strainers in water piping 1-1/2 inch size and larger with a full size drain valve with integral hose bibb connection, and chained cap, rated for 450 degrees F.

B. Install a short nipple and pipe cap in the blow-off outlets of strainers not specified or shown to have a blow-off valve or drain.

END OF SECTION

PART 1 GENERAL

1.01 PRODUCTS NOT PROVIDED UNDER THIS SECTION

A. Flashing and Trim: Construction Work Contract.

B. Openings in Steel, Precast Concrete and Prestressed Concrete Deck Units: Construction Work Contract.

1.02 REFERENCES

A. Unless otherwise specified, the Work of this Section shall meet the applicable requirements of ASME A112.21.2 - Roof Drains.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions.

B. Contract Closeout Submittals:
1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.

1.04 MAINTENANCE

A. Special Tools: Deliver to the Director's Representative.
1. Tools for Vandal Resistant Fasteners: One for each type and size.

PART 2 PRODUCTS

2.01 ROOF DRAINS

A. Drain Body: Coated cast iron, large size sump, minimum 15 inch dia, with integral bosses or lugs drilled and tapped for fastening flashing clamp and underdeck clamp, corrosion resistant bolts, bottom outlet, and connection to match piping option selected.

B. Flashing Clamp: Coated cast iron, non-puncturing type compression ring with integral, notched gravel stop and dome locking receiver.

C. Water Dam: For Roof Drains designated for Emergency Use, and minimum of 2" Internal Water Dam is to be included.

D. Dome Strainer: Coated cast iron, low profile type, with narrow vertical slotted openings, bayonet locking flange, secured with stainless steel vandal resistant fasteners.
1. Minimum Dome Strainer Opening Area:

CONNECTING PIPE SIZES (Inches Nominal)	**DOME STRAINER FREE AREA (Square inches)**
2	18
3	25
4	36
5	50
6	70

E. Sump Receiver: Galvanized steel plate, 22 gage minimum thickness, with opening sized to accept drain body flange, and flange recess of depth equal to drain sump flange thickness.
   1. Minimum Size: 4 sq. ft.

F. Underdeck Clamp: Coated cast iron or cast aluminum, drilled to match size of bolts and tap locations in drain body.

G. Acceptable Drain Series: Josam 21500, Smith 1010, Wade W3000, and Zurn Z100.

2.02 FASTENERS

A. Corrosion Resistant Fasteners: Brass, bronze, or Type 302 or 304 stainless steel bolts acceptable.

B. Vandal Resistant Fasteners: Torx head with center pin.

C. Anti-Seize Lubricant: Never-Seez by Bostik Chemical Group, Broadview, IL; Molycote 1000 by Dow Corning Corp, Midland, MI; Anti-Seize Lubricant by Loctite Corp, Newington, CT.

2.03 DOWNSPOUT NOZZLE

A. Body: Nickel Bronze with decorative wall flange and outlet nozzle. Hinged flapper or bird screen to be vandal resistant.

B. Acceptable Drain Series: Watts RD-940-83, and Zurn ZF199.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this Section in accordance with manufacturer's printed installation instructions, unless otherwise specified.

B. Coordinate drain installation with deck and roofing Work.

C. Coordinate drain installation with Construction Work Contractor.

D. Unless otherwise indicated by dimensions on the Drawings, locate drains as follows:
   1. Place drains minimum 3 feet away from items on roof (parapets, walls, gravelstops, pipes, vents, scuttles, equipment and curbs, etc.) to allow for flashing.
   2. Install drains at low points of roof deck and where normal deck deflection will be at its maximum.

E. Drains in Cast Concrete: Set and securely brace drain body so that sump flange is level with, or slightly below surface of concrete.

F. Drains in Wood Decks: Set sump receiver surface level with the deck surface. Secure drain body with underdeck clamp.

G. Drains in Steel Decks: Install drains as shown on the Construction Work Drawings.
   1. Do not core drill or cut openings. Coordinate roof deck openings with Construction Work Contractor.
   2. Set sump receiver surface level with deck surface.
   3. Secure drain body with underdeck clamp.

H. Drains in Pre-cast and Pre-stressed Concrete Deck Units: Install drains as shown on the Construction Work Drawings.
   1. Do not core drill or cut openings.
   2. Coordinate roof deck openings with Construction Work Contractor. Set sump receiver surface level with deck surface.
   3. Secure drain body with underdeck clamp.

I. Fasteners:
   1. Coat bolt threads with anti-seize lubricant before final installation.
   2. Secure external components in place with vandal resistant fasteners or devices which cannot be removed without special tools.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Sump pump

B. Pump controls and accessories

C. Cover thickness schedule

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Deliver the sump frame to the Construction Work contractor for installation.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: Section 310000.

B. Cast-In-Place Concrete: Section 033001.

C. Painting: Section 099103.

D. Pipe and Pipe Fittings: Section 221100.

E. Valves: Section 220523.

F. Wiring for Motors and Motor Controllers: Section 260523.

G. Motors and Motor Controllers: 260221.

1.04 SUBMITTALS

A. Product Data:
   1. Catalog sheets, specifications, installation instructions, including pump capacity curve (capacity vs. head) and electrical schematics.
   2. Catalog sheets, specifications, and installation instructions for the sump basin and cover.
   3. Catalog sheets, specifications and installation instructions for the sump cover and sump frame.

PART 2 PRODUCTS

2.01 SUMP PUMP

A. Type: Completely submersible, automatic operation, with a screenless suction, non-clog impeller, and lifting bail.
   1. Motor Requirements (Supplementary to Section 260221):
      a. Equip submersible motor with built-in thermal overload protection.
      b. Power Requirements: Design to operate on a single phase, 60 Hertz, 120 volt circuit (NEMA standard motor voltage 115 V).
      c. Power Cord: Waterproof, oil resistant, terminating with a 3 prong grounding type cord cap. Length as required.

B. Materials:
   1. Casing, exterior covers and caps: Brass or bronze.
   2. Impeller: Bronze.
   3. Shaft: Steel, sealed against contact with moisture.

4. Exterior fasteners: Stainless steel.

2.02 PUMP CONTROLS AND ACCESSORIES

A. Liquid Level Control Device: Construct of corrosion resistant materials, with components designed for installation within the sump completely waterproof, including oil resistant grounding type power cord.
   1. Type: Integral with sump pump.
   2. Type: Designed for remote installation. Furnish with stainless steel mounting clamps and stainless steel fasteners.

B. High Water Alarm: Factory wired assembly consisting of a 4 inch alarm bell, transformer, warning light, silencing switch, housed in a NEMA-1 enclosure, and liquid level control actuated.

C. Wall Panel: 3/4 inch plywood, APA grade A-D; exterior glue, plain sliced face veneer, finished, beveled edges all around. Construct of sufficient size for mounting high water alarm and control panel.

2.03 SUMP

A. Sump Basin: Cast iron, coal tar enamel coated, with hubbed inlets, and flanged top drilled and tapped for bolted cover.

B. Basin Cover: Steel or cast iron, coal tar enamel coated and drilled for bolting to sump basin. Fabricate openings in cover for pump access, power cord and discharge pipe. Provide rubber grommet in cover to protect power cord.

2.04 SUMP COVER AND FRAME

A. Cover: Steel or cast iron, coal tar enamel coated, with openings for pump access, power cord and discharge pipe. Provide rubber grommet in cover to protect power cord.

B. Frame: Steel, 1/2 inch minimum thickness, square shaped and provided with concrete anchors. Fabricate with recessed shoulder for flush mounting cover with finished floor.

2.05 COVER THICKNESS SCHEDULE

SUMP SIZE (INCHES)	**MINIMUM COVER THICKNESS (INCHES)**	
Round or Square	**Steel**	**Cast Iron**
24	1/2	5/8
30	1/2	5/8
36	1/2	5/8
42	1/2	3/4
48	5/8	7/8
60	5/8	1
72	5/8	1

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed installation instructions unless otherwise specified.

B. Install liquid level control device at proper elevation to produce specified sump drawdown. Secure control device to pump discharge pipe with clamps or to side of sump basin with corrosion resistant brackets and fasteners.

C. High Water Alarm: Install high water alarm and make electrical connections. Install liquid level control device at proper elevation to activate alarm at specified liquid depth. Secure control device to pump discharge pipe with clamps or to side of sump basin with corrosion resistant brackets and fasteners.

D. Control Panel: Install and make electrical connections. Install liquid level control devices at elevation required to produce specified sump drawdown. Secure control devices to pump discharge pipe with clamps, or to side of sump basin with corrosion resistant brackets and fasteners.

E. Wall Panel: Mount wall panel where directed and secure with suitable fasteners.

F. Prefabricated Sump: Install sump basin on a level firm base, make piping connections. Secure sump cover; seal gastight.

G. Sump Frame: Install level at proper elevation.

H. Install sump cover.

3.02 PUMP OPERATION

A. Single Pump System: Set level controls to start pump when liquid depth in sump reaches 12 inches and stop pump when liquid depth is 6 inches from inlet pipe.

B. Duplex Pump System: Set level controls to start the first (lead) pump when liquid in sump reaches 12 inches, and to start the standby (lag) pump when level rises to 6 inches from inlet pipe, and to stop both pumps when liquid depth decreases to 3 inches.
   1. Alternate lead and lag pumps with each operation cycle.

C. High Water Alarm Setting: Set control device to sound alarm when liquid depth in the sump reaches a set height.

3.03 FIELD QUALITY CONTROL

A. Test sump pump system for proper operation at specified liquid depths.

B. Test high water alarm for proper operation at specified liquid depth.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Requirements for electric water heaters

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Valves: Section 220523.

B. Electric Work: Division 26.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions for each water heater.

B. Contract Closeout Submittals:
   1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.
   2. Warranty: Copy of specified warranty.

1.04 REGULATORY REQUIREMENTS

A. Water heater shall be UL listed and labeled.

B. Comply with the State Energy Conservation Construction Code.

1.05 WARRANTY

A. Manufacturer's Warranty: Three year warranty for the glass lined water heater tank.

PART 2 PRODUCTS

2.01 **ELECTRIC WATER HEATER**

A. Tank: Welded steel, factory tested at 300 psi and rated for 150 psi working pressure.
   1. Glass lining permanently bonded to tank interior surface.
   2. Tank nipples factory installed.
   3. Renewable magnesium anode.
   4. Corrosion resistant dip tube.
   5. Drain and relief valve tappings.
   6. Renewable bronze boiler drain.

B. Heating Elements: Immersion type, replaceable; 75 watts per square inch maximum watt density.

C. Thermostat: Adjustable, interlocked with overheat control, including automatic shut-off.

D. Wiring: Factory interwired, requiring only a single field electric connection to put the heater into service.

E. Outer Casing: Steel with baked enamel or acrylic finish.
   1. Access door for servicing thermostats and heating elements.

F. Pressure-Temperature Relief Valve: AGA Z21.22; bronze body with stainless steel internals and threaded blow-off connection.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions, unless otherwise specified.

B. Install the water heater on a level, firm base.

C. Install the pressure-temperature relief valve in the dedicated tank tapping. Pipe the relief valve blow-off to a point 6 inches above the floor.

D. Provide ball valves on hot and cold water connections.

E. Make final piping connections with unions.

F. Flush and fill tank. Do not switch on heating elements until tank is full and entrapped air is eliminated.

END OF SECTION

PART 1 GENERAL

1.01 **SECTION INCLUDES**

A. Mop service sink

B. Lavatory

C. Supports and supporting devices for wall-mounted lavatories, sinks, and equipment

D. Countertop sink

E. Vitreous china water closets

F. Water closet carrier

G. Vitreous china urinals

H. Urinal carrier

I. Flush valves

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Sealants: Section 079200.

1.03 SUBMITTALS

A. Product Data: Catalog sheets, specifications, roughing dimensions, and installation instructions for each item specified except fasteners.
   1. Deliver cut out data for countertop fixtures to the Director's Representative.

B. Samples:
   1. Water Closet Seat: One seat if other than product specified. Sample will be returned and if approved, may be installed on the Project.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with applicable requirements of FS WW-P-541, and the following standards:
      a. ANSI/ASME A112.6.1M - Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
      b. ANSI/ASME A112.18.1M - Plumbing Fixture Fittings.
      c. ANSI/ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
      d. ANSI/ASME A112.19.2M - Vitreous China Plumbing Fixtures.
      e. ANSI/ASME A112.19.6 - Hydraulic Requirements for Water Closets and Urinals.
   2. Materials and installations designated as handicapped accessible shall conform with the following:
      a. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
      b. The Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), (Appendix A to 28 CFR Part 36).
      c. The Uniform Federal Accessibility Standards (UFAS), (Appendix A to 41 CFR Part 101-19.6).

3. Each fixture carrier support shall be listed by model number in the fixture support manufacturer's Fixture Support Selection Guide as being recommended for support of the appropriate fixture.

B. Plainly and permanently mark each fixture and fitting with the manufacturer's name or trade mark.

C. Acid resistant surfaces shall be plainly and permanently marked with the manufacturer's label or symbol indicating acid resistance.

1.05 MAINTENANCE

A. Special Tools: Deliver to the Director's Representative.
1. Furnish the following tools labeled with names and locations where used.
a. Keys for stops (furnished with stops).
b. Tools for Vandal Resistant Fasteners: Two for each type and size.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

A. Vitreous China: First quality, smooth, uniform color and texture, with fused on glaze covering surfaces exposed to view.
1. Surfaces shall be free of chips, craze, warpage, cracks and discolorations. Surfaces in contact with walls or floors shall be flat, with warpage not to exceed 1/16 inch per foot.
2. Color: White.

B. Porcelain Enameled Cast Iron: Smooth, uniform color and texture, having fused on glaze covering surfaces exposed to view.
1. Material shall show no cracks, chips, craze or discolorations.
2. Enameled surfaces shall be acid resistant unless otherwise specified.
3. Color: White.

C. Fixture Trim: Brass, bronze, or stainless steel construction; consisting of supply and waste fittings, faucets, traps, stop valves, escutcheons, sink strainers, nipples, supplies, and metal trim.
1. Brass piping: Ips standard weight, with standard weight, 125 lb cast brass fittings.
2. Brass tubing: 18 B & S gage.
3. Stainless steel: 18-8 Type 302 or 304 unless otherwise specified.

D. Fixture Trim Finishes:
1. Brass or Bronze: Polished or satin finished chrome plating, 0.02 mil chromium over 0.2 mil nickel plating.
2. Stainless Steel: Invisible welds and seams, and unless otherwise specified, polished to No. 4 commercial finish.

E. Fixture Hold-down Bolts: Steel, plated for corrosion resistance.
1. Cap nuts: Metal, polished and chrome plated.

F. Combination Faucets: Faucets shall turn counter to each other for the on and off positions.

G. For Vandal Resistant Fixtures - Fasteners: Torx head with center pin.

2.02 MOP SERVICE SINK

A. Receptor – See plans for make and model:

B. Drain Fitting: Cast iron or cast brass body integral or attached to the receptor, ready for connection. Strainer grate shall be polished brass or stainless steel, removable for cleaning.

C. Service Fitting: Combination faucet with 3/4 inch hose end spout, and with the following features.
   1. 1/2 inch eccentric inlets on 8 inch centers and integral stops.
   2. Integral wall flanges.
   3. Renewable units.
   4. Metal, four arm or lever, indexed handles.
   5. Integral vacuum breaker.
   6. 10 inches from finished wall to center of spout outlet.
   7. Five foot rubber hose with threaded connector to fit the hose bibb.
      a. Hose wall hook.

D. Rim Guard: Anodized aluminum, stainless steel, or pre-molded vinyl plastic, as recommended by the receptor manufacturer.

E. Wall Guard: Anodized aluminum, stainless steel, or pre-molded vinyl plastic, as recommended by the receptor manufacturer.

2.03 LAVATORY

A. Fixture: See plans for make and model.

B. Supply Fitting: See plans for make and model.
   1. Maximum Flow: 0.5 gpm at 80 psi.
      a. Exception: Metering faucets shall have a maximum flow of 0.25 gallons per cycle.
   2. Over rim spout with aerator.
   3. Renewable operating units.
   4. Vandal resistant assembly.
   5. 1/2 inch inlet lock nut and coupling nut.
   6. Operators:
      a. Standard Fixtures: Metal four arm indexed handles, with either integral splines, or ceramic spline inserts. Plastic spline inserts will not be accepted.
      b. Handicapped Accessible Fixtures: Metal 4 inch minimum indexed blade handles set, with either integral splines, or ceramic spline inserts. Plastic spline inserts will not be accepted.
         1) Maximum Activation Force: 5 lbf.

C. Waste Fitting: Grid Strainer.
   1. Metal grid strainer to match fixture finish.
   2. Cast escutcheon.
   3. 1-1/4 inch tailpiece.
   4. Vandal resistant assembly.

D. Trap: Cast brass, non-adjustable P trap, 1-1/4 inch tubing inlet, 1-1/2 inch ips outlet.
   1. Bottom cleanout plug.
   2. Ips brass nipple with solid cast brass escutcheon.

E. Supplies: 3/8 inch ips brass with operated stops and solid cast brass escutcheons.
   1. Wall Supplies: Angle stops.

F. Faucet Hole Cover: Cast brass, rounded top, and threaded shank, with backing plate, lock washer and nut.

2.04 FIXTURE SUPPORTS AND SUPPORTING DEVICES FOR LAVATORIES, SINKS, AND EQUIPMENT

A. General: Ferrous metal members of carriers and supporting devices with the exception of chrome plated or porcelain enameled cast iron, shall be factory painted for corrosion resistance.

B. Floor Mounted Carrier Supports: Steel pipe uprights, 1-1/4 inch ips minimum diameter, or 1 inch x 3 inch steel tubing uprights, with cast iron or welded steel feet, drilled for bolting to the floor construction. Each carrier shall be provided with the appropriate fixture supporting devices specified, or recommended by the carrier manufacturer's Fixture Support Selection Guide.
   1. Concealed Arms: Steel, with fixture locking lugs, leveling screws and a means of attaching, positioning and securing the fixture to the carrier.
      a. Trim: Polished, chrome plated metal escutcheon to space fixture two inches from the wall.
      b. Vandal Resistant Trim: Polished, chrome plated metal cap nuts and washers retained with vandal resistant set screws or other approved means of securing trim.

C. Wood Stud Filler Piece: 2 inch x 8 inch wood planking cut to fit between wood studding. Fasten with four 3/8 inch x 2-1/2 inch lag bolts with washers.

2.05 COUNTERTOP SINK

A. Material: See plans for make and model.
   1. Features: Self-rimming, extended back ledge, with faucet and spray hose punchings spaced on 4 inch centers. Cove corners 1-3/4 inch minimum radius; fully coat underside with sound deadening and condensation barrier.
   2. Finish: Satin finish exposed surfaces.

B. Supply Fitting: See plans for make and model.
   1. Maximum Flow: 2.5 gpm at 80 psi.
   2. 8 inch swing spout.
   3. 1/2 inch inlets on 8 inch centers.
   4. Renewable units.
   5. Supplies: 1/2 inch ips brass, with angle stops, and cast brass escutcheons.

C. Drain Assembly:
   1. Stainless steel removable strainer basket with neoprene stopper and 1-1/2 inch tubing tailpiece.

D. Fastening Devices: Stainless steel spring clip assemblies or clamping devices for securing sink to the countertop.

2.06 VITREOUS CHINA WATER CLOSETS

A. Fixtures: See plans for make and model.

B. Vitreous china, full size, elongated bowl with integral flushing rim and jet; trapway at the rear and the outlet centered between a pair of hold down bolt holes.
   1. Trapway size: Pass minimum ball of 2 inches.
   2. Trap seal: 2 inches minimum.
   3. Water surface area: 12 inches x 10 inches minimum.
   4. Provisions for flushing:
      a. 1-1/2 inch spud for flush valve operation.
   5. Floor Supported Fixture Heights:
      a. Standard Fixture: 14 to 15 inches from finished floor to rim.

b. Handicapped Accessible Fixture: 17 to 19 inches from finished floor to top of seat (15-13/16 to 17-13/16 inches from finished floor to top of rim based on 1-3/16 inch seat height).

C. Operation: Fixture shall flush satisfactorily without extraordinary rise of water level in the bowl.
1. Maximum gallons of water per flush: 1.6 gallons.

D. TYPE F WATER CLOSET: Flush Tank: Vitreous china secured to and supported by the closet bowl and separate lift off cover with provisions for locking.
1. Float valve with nylon seat and vacuum breaker.
2. Flushing valve.
3. Metal trip lever.
4. Supply: 1/2 inch ips brass pipe with a key operated stop and solid cast brass escutcheon.

E. TYPE A, C, F WATER CLOSETS: Water Closet Floor Flange:
1. For Use with DWV Copper Tubing: Cast brass, 48 ounce minimum weight.
2. For Use with Cast Iron Soil Pipe: Cast iron, 90 ounce minimum weight.

F. Closet Seat: Extra heavy duty, commercial design; Model 1655-C by Bemis Mfg. Co., Model No. 527-CH by Beneke Corp., or Model No. 9500C by Church Seat Co.
1. Material and Construction: Solid plastic, open front, less cover, molded in one piece with no joints, seams or crevices.
2. The manufacturer's name shall be molded into the seat.
3. Metal check hinges shall be integrally molded into the seat. Hinges, inserts, bearings and posts shall be of brass or stainless steel. Cover upper post and metal exposed above fixture rim with plastic to match seat.
4. Surface shall be hard, polished, impervious to moisture, and not affected by the action of uric acid.
5. Color: White.

G. Water Closet Types:
1. Type A Water Closet: Floor supported, floor outlet, top spud inlet, siphon jet action, activated by an exposed flush valve.
2. Type C Water Closet: Floor supported, floor outlet, top spud inlet integral seat, siphon jet action, operated by means of an exposed flush valve.
3. Type E Water Closet: Wall hung, back outlet, back spud inlet, siphon jet action, activated by means of a concealed flush valve.
4. Type E-1 Water Closet: Wall hung, back outlet, top spud inlet, siphon jet action, activated by means of an exposed flush valve.
5. Type E-2 Water Closet: Wall hung, back outlet, back spud inlet, integral seat, siphon jet action, operated by means of a concealed flush valve.
6. Type F Water Closet: Floor supported, close coupled fixture-tank combination, floor outlet, siphon jet action, flush tank operated.

2.07 WATER CLOSET CARRIER

A. Closet Carrier (For Wall Hung Water Closets): Commercial type cast iron combination chair carrier and drainage fitting with the following:
1. Face Plate: Cast iron; height adjustable.
2. Feet: Cast iron, adjustable, with provisions for bolting to the floor slab.
3. Studs, Nuts and Washers: Steel, treated for corrosion resistance.
4. Fixture Washers: Plastic.
5. Adjustable Closet Connection: Cast iron, steel, or ABS plastic.
6. Fitting Ends: Compatible with the drainage piping system.
7. Gasket: Impregnated felt or neoprene closet gasket; lead or neoprene face plate gasket.

8. Stud thread protectors.
9. Factory painted.
10. Trim: Polished chrome plated metal cap nuts and washers.
11. Vandal Resistant Trim: Polished chrome plated metal cap nuts and washers retained with vandal resistant set screws.

B. Closet Carrier (Residential For Wall Hung Water Closets): Cast iron or formed steel combination fixture carrier with waste fitting, or fixture carrier with fitting adapter, and arranged for mounting to wood studding. Include the following:
1. Closet Connection: Cast iron or steel with “O” ring seal; brass for copper drainage systems; adjustable.
2. Closet Gasket: Impregnated felt or neoprene.
3. Waste Fitting: Same material as drainage piping.
4. Studs, Nuts and Washers: Steel, treated for corrosion resistance.
5. Fixture Washers: Plastic.
6. Stud thread protectors.
7. Factory painted.
8. Trim: Polished chrome plated metal cap nuts and washers.
9. Vandal Resistant Trim: Polished chrome plated metal cap nuts and washers retained with set vandal resistant screws.

C. Ferrous metal members of carriers and supporting devices with the exception of chrome plated or porcelain enameled cast iron, shall be factory painted for corrosion resistance.

2.08 VITREOUS CHINA URINALS

A. Wall Supported Fixture: Vitreous china, with elongated rim, integral trap and extended side shields.
1. Dimensions (approx.): 28 inches high, 18 inches wide, 12 inches front to back.
2. Method of Support: Wall hangers and lugs for bearing plate bolting.

B. Operation: Fixture shall flush satisfactorily with a maximum of one gallon of water and be accomplished without extraordinary rise in water level in the bowl.

C. Fixture Types:
1. Type A Urinal: Floor supported, siphon jet action, with a bottom outlet and a 1-1/4 inch top spud inlet for an exposed flush valve connection.
2. Type B Urinal: Wall supported, blowout action, back outlet and a 1-1/4 inch back spud inlet for a concealed flush valve connection.
3. Type B-1 Urinal: Wall supported, blowout action, back outlet and a 1-1/4 inch top spud inlet for an exposed flush valve connection.
4. Type C Urinal: Wall supported, washout action, back outlet, and a 3/4 inch back spud inlet for a concealed flush valve connection.
5. Type C-1 Urinal: Wall supported, washout action, back outlet, and a 3/4 inch top spud inlet for an exposed flush valve connection.

2.09 URINAL CARRIER

A. Floor Mounted Carrier Support (For Wall Hung Urinals): 1-1/4 inch ips steel pipe upright supports with block feet arranged with provisions for bolting to the floor slab, and with the following:
1. Hanger Plate: Steel, height adjustable with provisions for mounting and positioning the fixture hanger.
2. Bearing Plate: Steel, adjustable, with bearing studs, nuts and washers.
3. Studs, Nuts and Washers: Steel, treated for corrosion resistance.

4. Fixture Washers: Plastic.
5. Stud thread protectors.
6. Factory Painted.
7. Trim: Polished chrome plated metal cap nuts and washers.
8. Vandal Resistant Trim: Polished chrome plated metal cap nuts and washers retained with vandal resistant set screws.

B. Ferrous metal members of carriers and supporting devices with the exception of chrome plated or porcelain enameled cast iron, shall be factory painted for corrosion resistance.

2.10 FLUSH VALVES

A. Control Mechanism: Diaphragm or piston operated; do not intermix types. See plans for make and model.

B. Maximum Flow Per Flush:
1. Water Closet: 1.6 gallons.
2. Urinal: 0.125 gallons.

C. Flush Valve Assemblies: Flush valve, stop-check, tailpiece, vacuum breaker, and fixture spud coupling, including wall and spud flanges.

D. Valve Materials:
1. Valve Body: Brass or bronze.
2. Valve Internal Parts: Corrosion resistant materials that will not be affected by the action of or contact with water.

E. Operating Features:
1. Valve operators shall employ the non hold-open feature.
2. Piston type valves shall be field adjustable.

F. Valve Operators:
1. Oscillating Handle: 4 inch brass spring loaded self return handle.
2. Oscillating Disc: 3 inch diameter, cast brass, spring loaded and self returning.
   a. Concealed Installations: Furnish wall escutcheon with operators.
3. Push Button Operator: 1 inch cast brass spring loaded push button, wall escutcheon, sleeve with guides and brass push rod; vandal resistant assembly.
4. Maximum Activation Force (Handicapped Accessible Operators): 5 lbf.

G. Assembly Components:
1. Flush Pipe: Seamless brass tubing with integral vacuum breaker, No. 18 B & S gage.
2. Fitting: Cast brass.
3. Stop-Check: Brass or bronze body, non rising stem stop valve with a built-in automatic check.
   a. Exposed Stop-Check: Screwdriver operated with protective cap.
   b. Concealed Stop-Check: Wheel handle operated.
4. Spud Coupling and Wall Flanges: Cast brass.

PART 3 EXECUTION

3.01 FIXTURE SUPPORT AND SUPPORTING DEVICE INSTALLATION

A. Install heavy duty floor mounted carrier supports with specified fixture supporting devices for wall type plumbing fixtures.

1. Secure to building construction with lag bolts and metal expansion shields, or other appropriate means as required by the construction encountered.

B. Wall Mounted Carrier Supports: Install the following fixtures on wall mounted carrier supports:

C. Fixture Supporting Devices: Attach fixtures by means of the following fixture supporting devices attached to carrier supports.

FIXTURE	SUPPORTING DEVICE
Clinical Service Sink	Fixture hangers & bearing
Lavatory, Vitreous China, with back	Concealed arms.
Lavatory, Vitreous China, slab type	Concealed arms.
Lavatory, Type D	Concealed arms.
Lavatory, Type E	Through bolt.
Water Closet	Bolt to comb. carrier and drainage fitting.
Urinal	Fixture hanger and bearing plate.
Drinking Fountain	Fixture hanger.
Water Cooler (wall mounted)	Fixture hanger.
Water Cooler (Recessed)	Mounting frame.

D. Secure exposed external components in place with vandal resistant fasteners or devices which cannot be removed without the use of special tools.

3.02 FIXTURE INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions.

B. Install fixtures level and at proper height, tighten connections, and install hold-down bolts, cap nuts and cover plates, where required.

C. Secure exposed external components in place with vandal resistant fasteners or devices which cannot be removed without the use of special tools.

D. Bathtubs:
1. Residential Type:
   a. Caulk joint between fixture wall and floor with Type 1D sealant; strike a neat joint.

E. Mop Service Sinks:
1. Set receptor leveled in bed of mortar laid on clean roughened surface. Remove excess mortar and strike a neat joint.
2. Make connection from drainage pipe to receptor drain.
3. Caulk joints between receptor and wall or floor with Type 1D sealant; strike a neat joint.
4. Install service fittings.

F. Lavatories:
1. Mount lavatories 31 inches from finished floor to rim unless otherwise specified.
2. Mount handicapped accessible fixtures 34 inches from finished floor to rim. Refer to Standard Drawing No. 93/S3013 bound herein, for special clearances required for handicapped accessible fixtures.
3. Caulk joint between fixture back and wall with Type 1D sealant; strike a neat joint.

G. Countertop Fixtures:
   1. Install fixture with securing devices supplied.
   2. Set fixture on bedding of sealant, tighten securing devices and remove excess sealant.

H. Water Closets:
   1. Wall Hung Fixtures:
      a. Standard Fixtures: Install wall hung fixtures 15 inches from finished floor to rim unless otherwise specified.
      b. Handicapped Accessible Fixtures: Install fixtures 18 inches from finished floor to top of seat (16-13/16 inches floor to rim based on 1-3/16 inches seat height).
      c. Set bearing nuts to position fixture 1/16 inch clear of finished wall.
      d. Caulk the joint between fixture back and wall with Type 1D sealant; strike a neat joint.
   2. Floor Supported Fixtures:
      a. Set fixture in bed of setting compound; remove excess.
      b. Caulk base perimeter with Type 1D sealant; strike a neat joint.
   3. After connections are tightened, install cap nuts and washers.
   4. Install water closet seats when directed.

I. Urinals:
   1. Wall Hung Fixtures:
      a. Standard Fixtures: Install wall hung fixtures 24 inches from finished floor to rim.
      b. Handicapped Accessible Fixtures: Install wall hung handicapped accessible fixtures 14 inches (minimum) to 17 inches (maximum) from finished floor to rim.
      c. Set bearing nuts on floor mounted carrier supports to position wall hung fixtures 1/16 inch clear of finished wall.
      d. Caulk the joint between fixture back and wall with Type 1D sealant; strike a neat joint.
   2. Floor Supported Fixtures:
      a. Install lip of urinal below floor level for proper floor drainage.
      b. Set fixture in bed of setting compound; remove excess.
      c. Caulk perimeter of fixture with Type 1D sealant; strike a neat joint.
   3. After connections are tightened, install cap nuts and washers.

J. Flush Valves:
   1. Standard Fixtures: Install flush valves on fixture centerline, and at following heights above fixture rim or back to centerline of water inlet to flush valve.
      a. Water Closet: 11-1/2 inches.
      b. Urinal: 11-1/2 inches.
   2. Handicapped Accessible Fixtures: Install flush valves on fixture centerline, and at following height above finished floor to centerline of flush valve operator. Distance between centerline of flush valve operator and centerline of water inlet is 1-1/2 inches.
      a. Water Closet: Approximately 31-1/2 inches, and mounted on wide side of stall.
         1) Coordinate mounting height with Construction Work Contractor to avoid interference with grab bar, and to facilitate flush valve servicing.
      b. Urinal: Maximum 44 inches.
   3. Set oscillating handles parallel to wall on exposed installation.
   4. Slip joints in flush pipe connections allowed only at fixture spud and vacuum breaker ends; others shall be screwed connections.
   5. Score tubing ends before assembling to assure tight slip joint connections. No score marks shall be visible after assembly.
   6. In utility corridors, solder screwed flush pipe connections.

3.03 CLEANING, FLUSHING AND ADJUSTMENT

A. Clean fixture and trim. Remove grease and dirt; polish surfaces but leave stickers and warning labels intact.

B. Flush supply piping and traps; clean strainers.

C. Adjust stops for proper delivery.

D. Adjust metering faucets for proper timing.

END OF SECTION

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Pipe and Pipe Fittings: Section 221100.

B. Sealants: Section 079200.

1.02 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each item including location and size of openings for shower head and mixing valve.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with applicable requirements of FS WW-P-541 unless otherwise specified.
   2. Materials and installations designated as handicapped accessible shall conform with the following:
      a. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
      b. The Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), (Appendix A to 28 CFR Part 36).
      c. The Uniform Federal Accessibility Standards (UFAS), (Appendix A to 41 CFR Part 101-19.6).

1.04 MAINTENANCE

A. Special Tools: One tool for each type and size vandal resistant fasteners.

PART 2 PRODUCTS

2.01 MATERIALS

A. Shower: See plans for make and model.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions except as specified otherwise.

B. Piping from Shower mixing valve to the tub spout shall be copper. No other pipe material is allowed.

C. Mounting Heights (Unless otherwise indicated): Distance between finished floor and centerline of item.
   1. Standard Showers:
      a. Shower Heads: 76 inches.
      b. Mixing Valves: 54 inches.
   2. Handicapped Accessible Showers:
      a. Shower Heads:
         1) Hand Held Type: 48 inches.
         2) Fixed Type: 48 inches.

b. Operating Controls (diverters, metering valves, mixing valves, etc.): 38 inches (minimum), 48 inches (maximum).

D. Installing Receptor On Masonry Floors:
1. Remove base or cove moulding.
2. Level receptor on mortar setting bed. Tool mortar back 3/8 inch from edges.
3. Apply sealant to mortar joint flush with face of receptor. Tool to a smooth cove shape between receptor and floor.
4. Calk drain connection with lead and oakum.

E. Installing Receptor On Wood Floors:
1. Remove floor covering at location of receptor.
2. Level receptor on mortar setting bed. Tool mortar back 3/8 inch from edges.
3. Apply sealant to mortar joint flush with face of receptor. Tool to a smooth cove shape between receptor and floor.
4. Calk drain connection with lead and oakum.

F. Operate mixing valve through its entire range; check for rated capacity.

G. Set mixing valve at full hot position and check delivered water temperature. Adjust the temperature limit stop for maximum 105 degrees F delivered water temperature.

H. Vandal Resistant Shower Heads:
1. Set and lock in place spray angle and delivery volume on all adjustable heads.
2. Test volume for delivery specified.

I. Calk the space between wall shower units, shrouds (where required), and walls with Type 1D sealant; strike a neat joint.

3.02 CLEANING

A. Remove protective coatings and thoroughly clean all exposed surfaces after all other trades have completed their Work.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General requirements for drinking fountains

B. ADA-compliant drinking fountain requirements

C. Exterior drinking fountain requirements

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Fixture Carrier Supports: Section 224200.

1.03 SUBMITTALS

A. Product Data: Manufacturer's catalog sheets, specifications and installation instructions for each type drinking fountain.

B. Contract Closeout Submittals:
   1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with applicable requirements of FS WW-P-541 unless otherwise specified.
   2. Comply with the Federal Safe Water Drinking Act of 1986, and the Federal Lead Contamination Control Act of 1988.
   3. Materials and installations designated as handicapped accessible shall conform with the following:
      a. ANSI A117.1 - Buildings and Facilities - Providing Accessibility and Usability for Physically Handicapped People.
      b. The Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG), (Appendix A to 28 CFR Part 36).
      c. The Uniform Federal Accessibility Standards (UFAS), (Appendix A to 41 CFR Part 101-19.6).

1.05 MAINTENANCE

A. Special Tools: Deliver the following to the Building Owner:
   1. Tools for Vandal Resistant Fasteners: One for each type and size.

PART 2 PRODUCTS

2.01 DRINKING FOUNTAINS

A. Type: Wall mounted, factory assembled, complete with trap, shut off valve and wall hanger.

B. Body: Polished or satin finished stainless steel, 18 gauge or heavier; with rounded corners, anti-splash back, and receptor contoured to eliminate splashing.

C. Features: Self closing supply valve, automatic stream regulator, two stream mound building projector and removable brass strainer plate.
   1. All exposed brass trim polished and chrome plated.

D. Selections: Refer to Contract Documents for Manufacturer and Model Number.
   1. Approved Manufacturers:
      a. Elkay, Murdock, Haws, Halsey Taylor, Oasis

E. Frost Proof Assembly: The supply valve body and trap assembly for the drinking fountain shall be housed in a steel plumbing cabinet and arranged for mounting on the opposite (heated) side of the building wall. All piping extending from the plumbing cabinet to the drinking fountain shall automatically drain to the heated side of the wall.
   1. Attach projector and valve handle with vandal resistant fasteners.
   2. Use vandal resistant fasteners where exposed on the drinking fountain and plumbing cabinet.

F. Operators: Front push bar or push bar on each side.
   1. Maximum Activation Force: 5 ft lbs.

G. Projector Clearance: Projector to back wall distance must be 12 inches or greater.

H. Fixture Hanger: Steel, designed to mount fixture to fixture support, as furnished by drinking fountain manufacturer. See Section 224200.

I. Selections: Refer to Contract Documents for Manufacturer and Model Number.

2.02 FASTENERS

A. Vandal Resistant Fasteners: Torx head with center pin.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions.

B. Standard Fixture Mounting Height (unless otherwise indicated on the Drawings): Distance finished floor to rim.
   1. Adult Usage: 40 inches.
   2. Child Usage: 29 inches.

C. Handicapped Accessible Fixture Mounting Height: Maximum distance finished floor to spout outlet.
   1. Handicapped Accessible Usage: 36 inches.

3.02 CLEANING, FLUSHING AND ADJUSTMENT

A. Clean and polish fixture and trim.

B. Flush piping; clean strainers and trap.

C. Adjust for proper delivery.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section describes the general requirements for all mechanical items and systems required by the Contract Documents.

B. Comply with all Contract Requirements, General Conditions, Supplementary Conditions and Division 1 Sections applying to or affecting the Work of Division 23.

C. Unless specifically dimensioned, the Work shown on the Drawings is in diagrammatic form only to show general arrangement.

D. Include, in the Work, all accessories and appurtenances, necessary and integral, for the intended operation of any system, component or device, as such systems, components and devices are specified.

E. Do not install pipe or conduit through ductwork.

F. If the pipe or duct size shown on the Drawings does not match the connection size of the equipment that it is connected to, provide the necessary transition pieces at the piece of equipment.

G. Do not use or allow to be used asbestos or asbestos-containing materials on this project. Be rigorous in assuring that all materials, equipment, systems and components thereof do not contain asbestos. Any deviations from this requirement shall be remedied at the Contractor's expense without regard to prior submittal approvals.

1.02 RELATED DOCUMENTS

A. The General Conditions and General Requirements Division 1 apply to the Work of this Section.

1.03 REFERENCE STANDARDS

A. Compliance with the following codes and standards shall be required:
1. Codes, Rules and Regulations of the State of New York
2. AABC American Air Balance Council
3. ADC Air Diffusion Council
4. AGA American Gas Association
5. AMCA Air Moving and Conditioning Association
6. ANSI American National Standards Institute
7. ARI American Refrigeration Institute
8. ASA Acoustical Society of America
9. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
10. ASME American Society of Mechanical Engineers
11. ASSE American Society of Sanitary Engineers
12. ASTM American Society for Testing Materials
13. AWS American Welding Society
14. AWWA American Water Works Association
15. BSA Board of Standards and Appeals
16. FM Factory Mutual
17. F.S. or FED Spec. Federal Specification
18. IRI Industrial Risk Insurers
19. MEA Materials and Equipment Acceptance

20.	MSS	Manufacturer's Standardization Society of the Valve and Fitting Industry
21.	NACE	National Association or Corrosion Engineers
22.	NEBB	National Environmental Balancing Bureau
23.	NEC	National Electrical Code (NFPA 70) / 2020
24.	NEMA	National Electrical Manufacturers Association
25.	NFPA	National Fire Protection Association
26.	OSHA	Occupational Safety and Health Act
27.	SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
28.	TEMA	Tubular Exchanger Manufacturers Association
29.	UL	Underwriters Laboratories, Inc.
30.	USAS	USA Standards Institute (Formerly ASA)

1.04 DEFINITIONS

A. "Provide" means furnish and install, complete the specified material, equipment or other items and perform all required labor to make a finished installation.

B. "Furnish and install" has the same meaning as given above for "Provide."

C. Refer to General Conditions for other definitions.

1.05 ABBREVIATIONS

A. Reference by abbreviation may be made in the Specifications and the Drawings in accordance with the following list:

1.	HVAC	Heating, Ventilating and Air Conditioning
2.	CM	Construction Manager
3.	AC	Air Conditioning
4.	H & V	Heating and Ventilating
5.	AWG	American Wire Gauge
6.	BWG	Birmingham Wire Gauge
7.	USS	United States Standard
8.	B & S	Brown & Sharpe
9.	OS & Y	Outside Screw and Yoke
10.	IBBM	Iron Body Brass Mounted
11.	WSP	Working Steam Pressure
12.	PSIG	Pounds per Square Inch Gauge
13.	PRV	Pressure Reducing Valve
14.	GPM	Gallons per Minute
15.	MBH	Thousand BTU per hour
16.	BTU	British Thermal Units
17.	WG	Water Gage
18.	LB	Pound (Also shown as: #)
19.	ASME	American Society of Mechanical Engineers
20.	ASTM	American Society for Testing Materials
21.	ABMA	American Boiler Manufacturers Association
22.	ASA	American Standards Associates
23.	MER	Mechanical Equipment Room

See Drawings for additional abbreviations

1.06 REVIEW OF CONTRACT DOCUMENTS AND SITE

A. Give written notice with the submission of bid to the Architect/Engineer of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules or

regulations of Authorities having jurisdiction, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his proposal for a complete project.

B. Contractors shall acknowledge that they have examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the Work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, utilities, roads and uncertainties of weather; the composition and condition of the ground; the characters quality and quantity of subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the Work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect the Work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for successfully performing the Work.

C. Owner assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract and the Contract expressly provides that the responsibility, therefore, is assumed by the Owner.

1.07 MEASUREMENTS

A. Base all measurements, both horizontal and vertical from established bench marks. Make all Work agree with these established lines and levels. Verify all measurements at site; and check the correctness of same as related to the Work.

1.08 LABOR AND MATERIALS

A. Provide all materials and apparatus required for the Work of new and first-class quality. Furnish, deliver, arrange, erect, connect and finish all materials and equipment in every detail, so selected and arranged as to fit properly into the building spaces.

B. Remove all materials delivered, or work erected, which does not comply with Drawings or Specifications, and replace with proper materials, or correct such work as directed, at no additional cost to the Owner.

1.09 COVERING OF WORK

A. Do not cover up or hide from view any duct, piping, fitting, or other work of any kind before it has been examined or approved by the Architect/Engineer and/or other authority having jurisdiction over the same. Remove and correct immediately any unacceptable or imperfect work or unauthorized or disapproved materials discovered immediately after being disapproved.

1.10 PROTECTION

A. Protect the Work and material of all trades from damage and replace all damaged material with new.

B. Protect work and equipment until the Work is finally inspected, tested, and accepted; protect the Work against theft, injury or damage; and carefully store material and equipment received on site which is not immediately installed; close open ends of work with temporary covers or plugs during construction to prevent entry of foreign material.

C. Preserve all public and private property, along and adjacent to the Work, and use every precaution necessary to prevent damage or injury thereto. Use suitable precautions to prevent damage to pipes, conduits and other underground structures or utilities, and carefully protect from disturbance or damage all property marks until an authorized agent has witnessed or otherwise referenced their location, and do not remove them until directed.

1.11 CUTTING AND PATCHING

A. Provide all cutting and rough patching required for the Work. Perform all finish patching.

B. Furnish and locate all sleeves and inserts required before the floors and walls are built, pay the cost of cutting and patching required for pipes where sleeves and inserts were not installed in time, or where incorrectly located. Provide all drilling required for the installation of hangers.

C. Punch or drill all holes cut through concrete slabs or arches from the underside. Do not cut structural members without the approval of the Architect/Engineer. Perform all cutting in a manner directed by the Architect/Engineer.

D. Do not do any cutting that may impair strength of building construction. Do no drill any holes, except for small screws, in beams or other structural members without obtaining prior approval. All Work shall be done in a neat manner by mechanics skilled in their trades and as approved.

1.12 SUBMITTALS

A. Submit for review, shop drawings for all materials and equipment furnished and installed under this Contract. Submissions shall include but not be limited to:
   1. Ductwork layout drawings, air devices and accessories
   2. Breeching layout drawings
   3. Piping and equipment layout drawings.
   4. Piping materials, valves, hangers, supports and accessories
   5. Automatic temperature control equipment, diagrams and control sequences
   6. Equipment, fixtures, and appurtenances
   7. Insulation
   8. Rigging Plan - Include the name of the rigging company; a layout drawing that details the crane with its outriggers extended outward. Provide dimensions showing how rigging operations will affect the road and parking lines being used, the type of crane and its specification including crane arm height, lift capacity, crane reach.

B. Reports
   1. Compliance with listings and approvals for equipment and for fire ratings.
   2. Acceptance certificates from inspecting agencies.
   3. Complete printed and illustrated operating instructions in report format.
   4. Manufacturer's performance tests of equipment.
   5. Field pipe and duct testing reports.
   6. Field operating test results for equipment.
   7. Performance report on the balancing of air and water systems.
   8. Performance reports for vibration isolation equipment.
   9. Manufacturer's reports on motorized equipment alignment and installation.

C. Specific references to any article, device, product or material, fixture or item of equipment by name, make or catalog number shall be interpreted as establishing a basis of cost and a standard of quality. All devices shall be of the make and type listed by Special Agencies, such as the Underwriters' Laboratories, and where required, approved by the Fire Department.

1.13 SPACE ALLOTMENTS AND SUBSTITUTIONS

A. The space allotments and equipment layouts on the Drawings are based on the manufacturer's model indicated or scheduled as the "Basis of Design". Ensure that any equipment that is submitted other than the "Basis of Design" will fit in the space allotment and will provide the necessary maintenance clearances as recommended by the manufacturer. If maintenance clearances are not met, pay for any changes such that maintenance clearances will be met.

B. Bear all costs associated with re-layout of the equipment, changes to piping/ductwork, and other changes as required if approved equipment other than the "Basis of Design" equipment is purchased. This shall also include any structural steel modifications and structural steel design changes. Submit, at no cost to the Owner, a steel design stamped by a structural engineer licensed in the state in which the Work is to be performed for structural modifications that must be made resulting from the use of equipment other than the "Basis of Design" or not specified.

1.14 PAINTING

A. Prime paint all bare supplemental steel, supports and hangers required for the installation of Division 23 Work in accordance with "Painting" Specification Section. Touch up welds of galvanized surfaces with galvanizing primer.

1.15 MATERIAL SAFETY DATA SHEETS

A. Submit material safety data sheets (MSDS) for all chemicals, hydraulic fluids, seal oils, lubricating oils, glycols and any other hazardous materials used in the performance of the Work, in accordance with the US Department of Labor, Occupational Safety and Health Administration (OSHA) hazard communication and right-to-know requirements stipulated in 29 CFR 1910.1200 (g).

1.16 MOTORS AND STARTERS

A. Provide new NEMA Standard electric motors, sized and designed to operate at full load and full speed continuously without causing noise, vibration, and temperature rise in excess of their rating. Provide motors with a service factor of at least 1.15.

B. Equip motors for belt driven equipment with rails with adjusting screws for belt tension adjustment. Weather protect motors exposed to the weather.

C. Install high efficiency electric motors for air handling units, relief fans, and exhaust fans.

D. Provide all motors for use with Variable Frequency Drives with "high efficiency inverter duty" insulation class "F" with class "B" temperature rise and that conform to or exceed the International Energy Conservation Code or the Federal EP Act of 1992 requirements for efficiency.

E. Provide stainless steel nameplates, permanently attached to the motor, and having the following information as a minimum:
   1. Manufacturer
   2. Type
   3. Model
   4. Horsepower
   5. Service Factor
   6. RPM
   7. Voltage/Phase/Frequency
   8. Enclosure Type

9. Frame Size
10. Full-Load Current
11. UL Label (where applicable)
12. Lead Connection Diagram
13. Bearing Data
14. Efficiency at Full Load.

F. Provide motors whose sound power levels do not exceed that recommended in NEMA MG 1-12.49.

G. Provide motors with drive shafts long enough to extend completely through belt sheaves when sheaves are properly aligned and balanced.

H. Protect motor starters on equipment located outdoors in weatherproof NEMA 4X enclosures.

I. Provide weatherproof NEMA 4X disconnect switches when located outdoors.

J. Motor Characteristics:
1. 120V/1/60 Hz, 208V/1/60 Hz or 240V/1/60 Hz: Capacitor start, open drip-proof type, ball bearing, rated 40 C. continuous rise.
2. 208V/3/60 Hz, 240V/3/60 Hz or 460/3/60 Hz: NEMA B, normal starting torque, single speed, squirrel-cage type, open drip-proof, rated 40 C continuous rise, with ball bearings rated for B-10 life of 100,000 hours and fitted with grease fittings and relief ports. Provide motors with aluminum end brackets with steel inserts in bearing cavities.

1.17 ACOUSTICAL PERFORMANCE OF EQUIPMENT AND SYSTEMS

A. Install the Work in such a manner that noise levels from operation of motor driven equipment, whether airborne or structure-borne, and noise levels created by or within air handling equipment and air distribution and control media, do not to exceed sound pressure levels determined by the noise criteria curves published in the ASHRAE guide.

B. Acoustical Tests
1. Owner may direct the Contractor to conduct sound tests for those areas he deems too noisy.
2. If NC level exceeds the requirements of the Contract Documents due to improper installation or operation of mechanical systems, make changes or repairs to bring noise levels to within required levels.
3. Retest until specified criteria have been met.

1.18 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Instructions and Demonstration for Owner's Personnel
1. Provide operating and maintenance instruction to the Owner when project is completed and all HVAC equipment serving the building is ready to be turned over to the Owner.
2. Turn over the HVAC equipment to the Owner only after the final testing and proper balancing of HVAC systems.
3. Instruct the Owner's personnel in the use, operation and maintenance of all equipment of each system.
4. The above instruction requirements are in addition to that specified for specific equipment or systems. Conform to specified requirements if more stringent or longer instruction is specified for specific equipment or systems.

1.19 CODES, RULES, PERMITS & FEES

A. Give all necessary notices, obtain all permits and pay all government sales taxes, fees, and other costs, in connection with the Work. Unless indicated otherwise, fees for all utility connections, extensions, and tap fees for water, storm, sewer, gas, telephone, and electricity will be paid directly to utility companies and/or agencies by the Owner. File all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for the Work and deliver same to the Owner's Representative before request for acceptance and final payment for the Work.

B. Conform to the requirements of the NFPA, NEC, FM, UL and any other local or State codes which may govern.

1.20 RECORD DRAWINGS

A. During the progress of the Work, make a record set of drawings of all changes by which the actual installation differs from the Drawings.

B. Create all record drawings in AutoCAD version 2013 or later in .dwg format. Upon completion of the Work, submit to the Architect/Engineer for approval three complete sets of hard copies of the record drawings, of the same size as the Drawings for approval. Upon approval by the Architect/Engineer furnish the Owner a CD copy of the record drawings along with one hard copy for his records.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 CLEANING AND ADJUSTING

A. Cleaning
1. Blow out, clean and flush each system of piping and equipment, to thoroughly clean the systems.
2. Clean all materials and equipment; leave in condition ready to operate and ready to receive final finishes where required.
3. Clean the operating equipment and systems to be dust free inside and out.
4. Clean concealed and unoccupied areas such as plenums, pipe and duct spaces and equipment rooms to be free of rubbish and dust.

B. Adjusting
1. Adjust and align equipment interconnected with couplings or belts.
2. Adjust valves of all types and operating equipment of all types to provide proper operation.
3. Clean all strainers after system cleaning and flushing and again before system startup.

C. Lubrication
1. Lubricate equipment as recommended by the manufacturer, during temporary construction use.
2. Provide complete lubrication just prior to acceptance.

D. Permanent Equipment Operating During Construction
1. Use only in same service as the permanent applications.
2. Use disposable filters during temporary operation.

3. Replace expendable media, including belts used for temporary operation and similar materials just prior to acceptance of the Work.
4. Repack packing in equipment operated during construction just prior to system acceptance, using materials and methods specified by the equipment manufacturer.

E. Retouch or repaint equipment furnished with factory finish as required to provide same appearance as new.

F. Tools
1. Provide one set of specialized or non-standard maintenance tools and devices required for servicing the installed equipment.

3.02 EQUIPMENT BASES, PLATFORMS AND SUPPORTS

A. Provide supporting platforms, steel supports, anchor bolts, inserts, etc., for all equipment and apparatus provided.

B. Obtain prior approval for installation method of structural steel required to frame into building structural members for the proper support of equipment, conduit, etc. Welding will be permitted only when approved by the Architect/Engineer.

C. Submit shop drawings of supports to the Architect/Engineer for approval before fabricating or constructing.

D. Provide leveling channels, anchor bolts, complete with nuts and washers, for all apparatus and equipment secured to concrete pads and further supply exact information and dimensions for the location of these leveling channels, anchor bolts, inserts, concrete bases and pads.

E. Where supports are on concrete construction, take care not to weaken concrete or penetrate waterproofing.

3.03 ACCESSIBILITY

A. Install valves, dampers and other items requiring access conveniently and accessibly located with reference to the finished building.

3.04 USE OF EQUIPMENT

A. The use of any equipment, or any part thereof, even with the Owner's consent, is not an indication of acceptance of the Work on the part of the Owner, nor shall it be construed to obligate the Owner in any way to accept improper work or defective materials.

3.05 MODIFICATIONS OF EXISTING WORK

A. Coordinate the Work with all other contractors and provide necessary dimensions for all openings. Provide all cuts and openings which are necessary for the Work for passage of piping and ductwork

B. Upon completion, remove all temporary piping and equipment, shoring, scaffolds, etc., and leave all areas clean and free from material and debris resulting from the Work performed under this Section. Provide rough patching in areas required.

3.06 EQUIPMENT INSTALLATION

A. Locate and set equipment anchor bolts, dowels and aligning devices for equipment requiring them.

B. Level and shim the equipment; coordinate and oversee the grouting work.

C. Perform field assembly, installation and alignment of equipment under direct supervision provided by the manufacturer or with inspections, adjustments and approval by the manufacturer.

D. Alignment and Lubrication Certification for Motor Driven Apparatus
   1. After permanent installation has been made and connections have been completed, but before the equipment is continuously operated, have a qualified representative of the equipment manufacturer inspect the installation and report in writing on the manufacturer's letterhead on the following:
      a. Whether shaft, bearing, seal, coupling, and belt drive alignment and doweling is within the manufacturer’s required tolerances so that the equipment will remain aligned in the normal service intended by the Contract Documents and that no strain or distortion will occur in normal service.
      b. That all parts of the apparatus are properly lubricated for operation.
      c. That the installation is in accordance with manufacturer's instructions.
      d. That suitable maintenance and operating instructions have been provided for the Owner's use.
      e. Make any corrections to items that are required or recommended based on the manufacturer’s inspection and have the equipment re-inspected.

E. Belt Drives
   1. V-belt drives - a driving and driven sheave grooved for belts of trapezoidal cross-section. Construct belts of fabric and rubber so designed so as not to touch the bottom of the grooves, the power being transmitted by the contact between the belts and V-shaped groove sides. Design drives for a minimum of 150 percent of motor horsepower. Provide companion type driven sheaves.
   2. Select drives to provide for 12-1/2 percent variation in speed, plus or minus, from specified speed. Provide all motors with adjustable sheaves except where indicated otherwise in the Specifications or on the Drawings.
   3. Install all fans with adjustable pitch sheaves on their drive motors. Select sheaves to provide air quantities under specified conditions. Put air systems into operation, and determine as a result of the completed air balance the actual size of sheaves required to produce specified air quantities on installed systems. The adjustable pitch sheaves shall then be replaced with the proper size fixed sheaves. Remove adjustable pitch sheaves from premises. Provide fixed motor sheaves manufactured by Wood's.
   4. Where indicated on the Drawings or specified, provide spare motor, bearings, and belts.

F. Machinery Guards
   1. Protect motor drives by guards furnished by the equipment manufacturer or in accordance with the Sheet Metal and Air Conditioning Contractors National Association's Low Pressure Duct Manual. Provide guards of all types approved as acceptable under OSHA Standards.

G. Equipment Start-up
   1. Require each equipment manufacturer to provide qualified personnel to inspect and approve equipment and installation and to supervise the start-up of the equipment and to supervise the operating tests of the equipment.
   2. If a minimum number of hours for start-up and instruction are not stated with the equipment specifications, these shall be 2 full 8-hour working days as a minimum.
   3. Advise Owner of start-up at least 72 hours in advance.

3.07 CLOSEOUT PROCEDURES

A. Field Review and Punchlist:

1. Contractor shall submit written notice of substantial completion prior to requesting 'Substantial Completion Punchlist Inspection'.
2. Contractor shall submit all air and hydronic test balance reports a minimum of 5 days prior to requesting punchlist inspection. The reports shall be complete for all subject equipment. If any reports are missing or incomplete, contractor shall identify those items and provide a schedule of balancing completion and excepted report submission.
3. As applicable, contractor shall provide written record of successful piping pressure test for each piping system, on company letterhead, with required data per specification, duration of test, and photographic evidence of gauge at test pressure.
4. If contractor requests a punchlist inspection and engineer finds incomplete work within the work claimed to be substantially complete, the engineer will inform the contractor and may (at engineer's choice) terminate the inspection prior to reviewing all work. The Contractor will be responsible for reimbursing engineer for subsequent punchlist activities.
5. Upon receipt of engineer's punchlist inspection report, the contractor shall respond to each comment with an acknowledgement of each item (initialled, dated and photo evidence of completed work) or disagreement and written explanation of disagreement.
6. The contactor may respond with acknowledgement by providing photo of corrective action, or at the engineer's choice and upon contractor's written confirmation that all punchlist items have been addressed, may request a final punchlist inspection.

B. General Operating and Maintenance Instructions: Arrange for each installer of operating equipment and other work that requires regular or continuing maintenance, to meet at the site with the Owner's personnel to provide necessary basic instructions in the proper operation and maintenance of the entire Work. Where installers are not expert in the required procedures, include instruction by the manufacturer's representatives.

C. Where applicable, provide instruction and training, including application of special coatings systems, at manufacturer's recommendation.

D. Provide a detailed review of the following items:
   1. Maintenance manuals
   2. Record documents and catalog cuts for each piece of equipment.
   3. Spare parts and materials
   4. Tools
   5. Lubricants
   6. Fuels
   7. Identification systems
   8. Control sequences
   9. Hazards
   10. Cleaning

E. Warranties, bonds, maintenance agreements, and similar continuing commitments.

F. Demonstrate the following procedures:
   1. Start-up
   2. Shut-down
   3. Emergency operations
   4. Noise and vibration adjustments
   5. Safety procedures
   6. Economy and efficiency adjustments
   7. Effective energy utilization.

G. Prepare instruction periods to consist of approximately 50% classroom instruction and 50% "hands-on" instruction. Provide minimum instruction periods as follows:

Systems or Equipment	Training Time (Hours)
Chillers	16 hrs.
Cooling Towers	16 hrs.
Roof Top Units	8 hrs.
Air Handlers	8 hrs.
Boilers and Burners	16 hrs
DDC Control System	24 hrs.
All other equipment	4 hrs. (each)

Note: Consult individual equipment specification sections for additional training requirements.

H. Prepare a written agenda for each session and submit for review and approval. Include date, location, purpose, specific scope, proposed attendance and session duration.

I. Record training sessions in digital format, format as selected by the Owner. Turn over digital files to the Owner after training has been completed.

END OF SECTION 230010

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the draining, disconnecting, dismantling, demolition, removal, relocation, rerouting and reconnection of existing mechanical facilities, in a neat and workmanlike manner, of mechanical systems, materials and accessories as required, as shown on the Drawings and specified herein, to accomplish alteration, restoration and to accommodate the Work.

1.02 RELATED WORK

A. General Mechanical Requirements - Section 230010

1.03 REFERENCES

A. ANSI A10.6 - Safety Requirements for Demolition

B. BOCA Building Code

C. IBC (Including State Amendments)

D. NADC - Demolition Safety Manual

E. NFPA Fire Code

F. NFPA 51B - Cutting and Welding Processes

G. NFPA 70 - National Electrical Code

H. NFPA 241 - Safeguarding Building Construction and Demolition Operations

I. OSHA 29 CRF 1910 - Occupational Safety and Health Standards

J. US EPA - Clean Air Act Amendment of 1990.

1.04 SUBMITTALS

A. Demolition Schedule

B. Fire Watch Procedures

C. Inspection Report of Underground Piping Systems

D. Welding/Burning Permit - Obtain a welding/burning permit from the local Fire Official prior to the start of any welding or burning in accordance with the local Fire Code or as required by the Owner.

1.05 QUALITY ASSURANCE

A. Only employ workers skilled in the specific trades involved for cutting, patching and removal.

B. Job Conditions: Prior to start of the Work, make an inspection accompanied by the Architect/Engineer to determine physical condition of adjacent construction that is to remain.

1.06 SPECIAL PRECAUTIONS

A. Do not torch cut ductwork.

B. Torch cutting of other mechanical equipment will be permitted only with the specific written approval of the Architect/Engineer.

C. Include “Fire Watch” procedures as required by the Fire Code and/or Owner’s Fire Insurance Carrier for any cutting work that may produce sparks. Submit fire watch procedures for approval.

D. Perform draining operations so that damage to existing building components does not occur.

PART 2 - PRODUCTS

2.01 GENERAL

A. Adequately sized rubbish containers for the proper and safe disposal of all debris.

PART 3 - EXECUTION

3.01 PREPARATION

A. Construct temporary partitions enclosing respective work prior to any demolition work. Erect temporary fencing and signage around demolished materials.

B. Protect existing materials and equipment which are not to be demolished.

C. Prevent movement of structure; provide required bracing and shoring.

D. Do not begin the work until the time schedules and manner of operations have been approved by the Architect/Engineer and Owner. Include all interruptions of existing services in schedules submitted for approval by the Architect/Engineer and Owner.

3.02 GENERAL

A. Provide alteration and demolition of mechanical facilities as required by the Drawings and Specifications. The Drawings are diagrammatic and do not show the exact location of all existing mechanical work. Where existing equipment is to remain in service during construction, provide rerouting and reconnection of mechanical services as required to maintain continuous service.

B. Review all equipment with the Architect/Engineer and Owner prior to disposal. Completely remove existing ductwork, piping, conduit and similar items to be abandoned that are not embedded in walls or floor slabs unless otherwise shown on the Drawings. Cap open ends at all walls and floors.

C. Remove, store and protect all equipment or materials designated to be turned over to the Owner. Coordinate exact location of storage with the Owner.

D. Temporarily cap ends of ductwork, piping and sanitary vent piping to avoid entry of dirt, debris, or discharge of foul odors and gases.

E. Where existing louvers or ductwork penetrations are to remain, blank-off the opening on the inside with galvanized sheet metal on both sides of 2-inch thick, 6 pcf density rigid fiberglass board insulation. Paint side attached to the opening with weather resistant flat black paint.

F. Do not close or obstruct egress width to exits.

G. Do not disable or disrupt building fire or life safety systems without five (5) days prior written notice to the Architect/Engineer and Owner.

H. Conform to procedures applicable when discovering hazardous or contaminated materials.

I. Conduct demolition to minimize interference with adjacent building structures or Owner's operations.

J. Cease operations immediately if structure appears to be in danger or hazardous materials are encountered. Notify Architect/Engineer. Do not resume operations until directed.

K. Demolish in an orderly and careful manner. Do not cut or remove more than is necessary to accommodate the new construction or alteration.

L. Remove demolished materials from site daily. Do not burn or bury materials on site. Dispose of all material at an approved disposal facility.

M. Protect finished surfaces at all times and repair or replace, if damaged, to match existing construction to the satisfaction of the Architect/Engineer.

3.03 PIPING REMOVAL

A. Cut off all welded piping square at the locations indicated on the Drawings. No cutting is required where the demolition ends at a flanged valve or equipment. Close off all openings of any remaining valves, piping or fittings with weld caps or blind flanges to prevent debris from entering the existing system.

B. Disconnect all threaded piping at the location indicated on the Drawings. Close off all openings of remaining valves, piping, fittings and equipment with pipe plugs or pipe caps as required to prevent debris from entering the existing systems.

C. Remove all pipe hangers, supports, miscellaneous steel and anchors with the piping.

3.04 PROTECTION FROM FREEZING

A. It is intended that the building remain protected from damage due to freezing temperatures. To that end, keep in place and in operation existing equipment and systems used for heating until scheduling permits shutdown.

B. Where the removal of equipment, etc. will leave an area unprotected from freezing, notify the Owner and Architect/Engineer at least 72 hours in advance prior to removal so appropriate steps can be taken by the Owner to protect the area. Provide temporary heating equipment sufficient to prevent freezing.

C. It is the Contractor’s responsibility to ensure that piping systems that are being worked on are completely drained from water prior to the start of demolition. If water is not drained and the water freezes it is the Contractor’s responsibility to replace piping and repair all damages caused by water leakage at his own expense.

3.05 DISCONNECTION AND INTERRUPTION OF MECHANICAL SERVICES

A. When portions of an existing piping system or ductwork system are removed, and this removal causes loss of operation to another piece of equipment due to open or disconnected piping or ductwork, cap piping or ductwork or provide temporary piping or ductwork system to retain operation of the system.

3.06 MECHANICAL EQUIPMENT REMOVAL

A. Remove all mechanical equipment as shown on the Drawings. Remove all electrical work, including wiring between equipment, and wiring to power source or point of origin.

B. Where equipment is supported by steel and/or structural supports, remove these supports.

3.07 REFRIGERANT REMOVAL

A. Recover and dispose of all existing refrigerant charges in accordance with EPA regulations. Comply with all regulations applicable to the release of chlorofluorocarbon refrigerants to the atmosphere.

3.08 DUCTWORK REMOVAL

A. Disconnect all ductwork which must be removed, at the closest joint and support the remaining ductwork.

B. Prepare all remaining ductwork joints at the point of disconnection to receive new ducts or blank-off panels.

C. Remove all ductwork supports and miscellaneous steel with ductwork to be demolished.

3.09 INSULATION REMOVAL

A. Remove insulation, together with all piping, fittings, valves and equipment designated for demolition.

3.10 CONTROL WIRING REMOVAL

A. Disconnect and remove all control wiring and tubing, including conduit, for the Automatic Temperature Control (ATC) System associated with equipment and systems to be removed.

3.11 CONCRETE HOUSEKEEPING PAD REMOVALS

A. Unless noted otherwise on drawings, remove existing concrete housekeeping pads remaining unused as a result of equipment removals.
   1. Remove or cut dowels down flush to existing MER floor elevation to eliminate trip hazard.
   2. Grind down high points to be level with existing MER floor.
   3. Patch area of pad removal with concrete patch as required to fill in all holes and low points, and provide trowel smooth finish.
   4. If section of existing pad to remain, saw cut straight edge and grind a minimum 1/4" chamfer on sharp corners of existing pad edges to remain.

END OF SECTION 230015

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Work covered under this Section consists of the furnishing of all necessary labor, supervision, materials, equipment, and services to completely execute the pipe hanger and supports as described in this Specification. Size hangers and supports to fit the outside diameter of the piping.

1.02 REFERENCES

A. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel

B. ASTM A123 - Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip

C. ASTM A653 - Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process

D. ASTM A1011 - Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability (Formerly ASTM A570)

E. MSS SP58 - Manufacturers Standardization Society: Pipe Hangers and Supports- Materials, Design, and Manufacture

F. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.03 QUALITY ASSURANCE

A. Provide hangers and supports used in fire protection piping systems listed and labeled by Underwriters Laboratories.

B. Steel pipe hangers and supports shall have the manufacturer’s name, part number, and applicable size stamped in the part itself for identification.

C. Design and manufacture hangers and supports in conformance with MSS SP 58.

1.04 SUBMITTALS

A. Submit product data on all hanger and support devices, including shields and attachment methods. Include as a minimum as part of product data materials, finishes, approvals, load ratings, and dimensional information.

B. Submit Pipe Hanger and Support Application Schedule.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with these specifications, provide pipe hanger and support systems manufactured by:
   1. Cooper B-Line, Inc.
   2. Carpenter and Patterson
   3. Grinnell

2.02 PIPE HANGERS AND SUPPORTS

A. Hangers
   1. Uninsulated pipes 2 inch and smaller:
      a. Adjustable steel swivel ring (band type) hanger, B-Line B3170.
      b. Adjustable steel swivel J-hanger, B-Line B3690.
      c. Malleable iron ring hanger, B-Line B3198R or hinged ring hanger, B3198H.
      d. Malleable iron split-ring hanger with eye socket, B-Line B3173 with B3222.
      e. Adjustable steel clevis hanger, B-Line B3104 or B3100.
   2. Uninsulated pipes 2-1/2 inch and larger:ha
      a. Adjustable steel clevis hanger, B-Line B3100.
      b. Pipe roll with sockets, B-Line B3114.
      c. Adjustable steel yoke pipe roll, B-Line B3110.
   3. Insulated pipe- Hot or steam piping:
      a. 2 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. B-Line B3100 with B3151 series.
      b. 2-1/2 inch and larger pipes
         1) Adjustable steel yoke pipe roll with pipe covering protection saddle. B-Line B3110 with B3160-B3165 series.
         2) Pipe roll with sockets with pipe covering protection saddle, B-Line B3114 with B3160-B3165 series.
   4. Insulated pipe- Cold or chilled water piping:
      a. 5 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. B-Line B3100 with B3151 series.
      b. 6 inch and larger pipes:
         1) Pipe roll with sockets with pipe covering protection saddle, B-Line B3114 with B3160-B3165 series.
         2) Adjustable steel yoke pipe roll with pipe covering protection saddle. B-Line B3110 with B3160-B3165 series.

B. Pipe Clamps
   1. When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, B-Line B3140 or B3142 with B3200. For insulated lines use double bolted pipe clamps, B-Line B3144 or B3146 with B3200.

C. Multiple or Trapeze Hanger
   1. Construct trapeze hangers from 12 gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8 inch minimum, B-Line B22 strut or stronger as required.
   2. Mount pipes to trapeze with 2 piece pipe straps sized for outside diameter of pipe, B-Line B2000 Series.
   3. For pipes subjected to axial movement:
      a. Strut mounted roller support, B-Line B3126. Use pipe protection shield or saddles on insulated lines.
      b. Strut mounted pipe guide, B-Line B2417.

D. Wall Supports
   1. Pipes 4 inch and smaller:
      a. Carbon steel hook, B-Line B3191.
      b. Carbon steel J-hanger, B-Line B3690.
   2. Pipes larger than 4 inch:
      a. Welded strut bracket and pipe straps, B-Line B3064 and B2000 series.

b. Welded steel brackets, B-Line B3066 or B3067, with roller chair or adjustable steel yoke pipe roll. B-Line B3120 or B3110. Use pipe protection shield or saddles on insulated lines.

E. Floor Supports
1. Hot piping under 6 inch and all cold piping:
a. Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. B-Line B3093 and B3088T or B3090 and B3088. Screw or weld pipe saddle to appropriate base stand.
2. Hot piping 6 inch and larger:
a. Adjustable Roller stand with base plate, B-Line B3117SL
b. Adjustable roller support and steel support sized for elevation, B-Line B3124

F. Vertical Supports
1. Steel riser clamp sized to fit outside diameter of pipe, B-Line B3373.
2. Copper Tubing Supports
a. Size hangers to fit copper tubing outside diameters.
1) Adjustable steel swivel ring (band type) hanger, B-Line B3170CT.
2) Malleable iron ring hanger, B-Line B3198RCT or hinged ring hanger B3198HCT.
3) Malleable iron split-ring hanger with eye socket, B-Line B3173CT with B3222.
4) Adjustable steel clevis hanger, B-Line B3104CT.
b. For supporting vertical runs use epoxy painted or plastic coated riser clamps, B-Line B3373CT or B3373CTC.
c. For supporting copper tube to strut use epoxy painted pipe straps sized for copper tubing, B-Line B2000 series, or plastic inserted vibration isolation clamps, B-Line BVT series.

G. Plastic Pipe Supports
1. V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, B-Line B3106 and B3106V, to form a continuous support system for plastic pipe or flexible tubing.
2. Supplementary Structural Supports
a. Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Provide roll formed channels, 12 gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to Architect/Engineer for approval. Use clamps and fittings designed for use with the strut system.

H. Pipe Supports Between Anchors and Pipe Expansion Loops
1. Provide supports between pipe anchors designed to cause minimal resistance to piping movement. Provide roller hanger supports or slide plates between anchors.
2. Provide supports near the L bends of pipe thermal expansion loops. No more than 12 inches from either side of the horizontal elbow.

2.03 SPRING HANGERS

A. For critical high temperature piping, at hanger locations where the vertical movement of the piping is ¾ inch or more, or where it is necessary to avoid the transfer of load to adjacent hangers or connected equipment, provide approved constant support hangers. However, where the piping movement occurs at a hanger supporting a portion of piping riser on which a rigid support is also located, variable spring hangers may be used for any amount of expansion up to the full recommended working range of the spring, provided the change in supporting effect of the variable spring is added to the design load of the rigid support.

B. Where transfer of load to adjacent hangers or equipment is not critical, and where the vertical movement of the piping is less than ¾ inch, variable spring hangers may be used, provided the

variation in supporting effect does not exceed 25 percent of the calculated piping load through its total vertical travel.

C. The total travel for constant support hangers shall be equal to actual travel plus 20 percent. In no case shall the difference between actual and total travel be less than one inch.

D. Furnish constant support hangers with travel stops, which shall prevent upward and downward movement of the hanger. The travel stops shall be factory installed so that the hanger level is at the “cold” position. Design the travel stops to permit future reengagement, even in the event the lever is at a position other than “cold”, without having to make hanger adjustments.

E. For low temperature systems where vertical movements are anticipated, use approved precompressed variable spring hangers.

2.04 UPPER ATTACHMENTS

A. Beam Clamps
   1. Use beam clamps where piping is to be suspended from building steel. Select clamp type on the basis of load to be supported, and load configuration.
   2. Use center loaded beam clamps where specified. For steel clamps provide B-Line B3050, or B3055. For malleable iron or forged steel beam clamps with cross bolt provide B-Line B3054 or B3291-B3297 Series as required to fit beams.

B. Concrete Inserts
   1. Use cast in place spot concrete inserts where applicable; either steel or malleable iron body, B-Line B2500 or B3014. Select spot inserts to allow for lateral adjustment and to have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series.
   2. Use continuous concrete inserts where applicable. Provide 12 gauge channels, ASTM A1011 SS Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. Provide continuous concrete inserts with a load rating of 2,000 lbs/ft. in concrete, B-Line B22I, 32I, or 52I. Select channel nuts suitable for strut and rod sizes.
   3. Provide Drop-In, shell type anchors with an internally threaded, all-steel shell with expansion cone insert and flush embedment lip. Manufacture anchors from plated carbon steel, 18-8 stainless steel and 316 stainless steel. Install anchors with carbide tipped hammer drill bits made in accordance to ANSI B212.15-1994 specifications. Test anchors to ASTM E488 criteria and listed by ICC (formerly ICBO) and SBCCI. Provide anchors listed by the following agencies as required by the local building code: UL, FM. Select inserts to suit threaded hanger rod sizes, Redhead Multi-Set.

2.05 ACCESSORIES

A. Hanger Rods shall be threaded both ends or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.

B. Provide shields that are 180 degree galvanized sheet metal, 12 inch minimum length, 18 gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.

C. Pipe protection saddles shall be formed from carbon steel, 1/8 inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.

2.06 FINISHES

A. Indoor Finishes
   1. Coat hangers and clamps for support of bare copper piping with copper colored epoxy paint, B-Line Dura-Copper®. Use additional PVC coating of the epoxy painted hanger where necessary.
   2. Zinc plate hangers for other than bare copper pipe in accordance with ASTM B633 OR provide an electro-deposited green epoxy finish, B-Line Dura-Green®.
   3. Provide pre-galvanized strut channels in accordance with ASTM A653 SS Grade 33 G90 or provide an electro-deposited green epoxy finish, B-Line Dura-Green®.

B. Outdoor and Corrosive Area Finishes
   1. Hot dip galvanize hangers and struts located outdoors after fabrication in accordance with ASTM A123. Provide all hanger hardware as hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
   2. Provide hangers and strut manufactured of type 304 stainless steel with stainless steel hardware where located in corrosive areas.

PART 3 - EXECUTION

3.01 PIPE HANGERS AND SUPPORTS

A. Adequately support pipe by pipe hanger and supports specified in PART 2 PRODUCTS. Allow for forces imposed by expansion joints, satisfy structural requirements and maintain proper clearances with respect to adjacent piping, equipment and structures. Size hangers for insulated pipes sized to accommodate insulation thickness.

B. Keep the different types of hangers to a minimum and provide hangers that are neat, without complicated bolting and with the number of parts of each hanger and its anchor kept to a minimum.

C. Make accurate weight balance calculations to determine the required supporting forces at each hanger or support location and the pipe weight load at each equipment connection.

D. Provide pipe hangers capable of supporting the pipe in all conditions of operation selected to allow free expansion and contraction of the piping, and prevent excessive stress resulting from transferred weight being induced into the pipe or connected equipment.

E. Painted or shop prime all hangers and supports that are not galvanized.

F. Support horizontal steel piping in accordance with MSS SP-58 and NYS 2020 Mechanical Code, excerpts of which follow below:

NOMINAL PIPE SIZE (INCHES)	ROD DIAMETER (INCHES)	MAXIMUM SPACING (FEET)
1/2 to 1-1/4	3/8	7
1-1/2	3/8	9
2	3/8	10
2-1/2	1/2	11
3	1/2	12
3-1/2	1/2	12
4	5/8	12
5	5/8	12
6	3/4	12

8	3/4	12
10	7/8	12
12	7/8	12
14	1	12
16	1	12

G. Support horizontal copper tubing in accordance with MSS SP-58 and NYS 2020 Mechanical Code, excerpts of which follow below:

NOMINAL PIPE SIZE (INCHES)	ROD DIAMETER (INCHES)	MAXIMUM SPACING (FEET)
1/2 to 3/4	3/8	5
1	3/8	6
1-1/4	3/8	7
1-1/2	3/8	8
2	3/8	8
2-1/2	1/2	9
3	1/2	10
3-1/2	1/2	11
4	1/2	12
5	1/2	12
6	5/8	12
8	3/4	12

H. Provide means of preventing dissimilar metal contact such as plastic coated hangers, copper colored epoxy paint, or non adhesive isolation tape- B-Line Iso-pipe. Galvanized felt isolators sized for copper tubing may also be used, B-Line B3195CT.

I. Install hangers to provide a minimum of 1/2 inch space between finished covering and adjacent work.

J. Place a hanger within 12 inches of each horizontal elbow.

K. Support vertical piping independently of connected horizontal piping. Support vertical pipes at every floor. Wherever possible, locate riser clamps directly below pipe couplings or shear lugs.

L. Where several pipes can be installed in parallel and at the same elevation, provide trapeze hangers as specified in section 2.02 C. Space trapeze hangers according to the smallest pipe size, or install intermediate supports according to schedules in this Section.

M. Do not support piping from other pipes, ductwork or other equipment that is not building structure.

N. Where horizontal piping movements are greater than ½ inch, or where the hanger rod angularity from the vertical is greater than four degrees from the cold to hot position of the pipe, offset the hanger pipe and structural attachments in such a manner that the rod is vertical in the hot position.

O. In any part of the building which is steel-framed, attach hangers to the building structural steel beams. Where hangers do not correspond with the building structural steel beams, provide supplemental steel members continuously welded or bolted to the building structural steel beams. Provide two (2) coats of primer on the supplemental steel. In any parts of the building

which is a concrete structure, attach hangers to the concrete structure by installing anchors into the concrete.

3.02 CONCRETE INSERTS

A. Secure pipe hangers attached to concrete structure and slabs with embedded inserts, anchor bolts or concrete fasteners. Use a safety factor of 5 in selection of all inserts and expansion bolts unless there are seismic requirements (See “Seismic Restraint” specification if applicable). In which case, the larger of the two loadings shall govern the design.

B. Provide inserts for placement in formwork before concrete is poured.

C. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

D. Where concrete slabs form finished ceilings, provide inserts to be flush with slab surface.

E. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch.

END OF SECTION 230529

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the marking and identification materials for identifying mechanical equipment, ductwork and piping systems.

B. Mark and identify all mechanical equipment, ductwork and piping systems described herein, and as shown and specified in the Contract Documents.

1.02 REFERENCES

A. ANSI A13.1 - Scheme for the Identification of Piping Systems.

B. Z53.1 - Safety Color Code for Marking Physical Hazards.

C. OSHA 29 CFR 1910 - Subpart J, General Environmental Controls

1.03 SUBMITTALS

A. Identification Scheme - Submit scheme of identification codes.

B. Steam Trap Schedule - Submit steam trap schedules listing proposed steam trap number, location, type, sizes and service.

C. Valve Schedules - Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples - Submit samples of tags, attachments, labeled and identified.

E. Equipment Schedules - Submit mechanical equipment schedules, listing proposed equipment numbers, and their location and function.

F. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Seton

B. Bunting

C. W.H. Brady Company

2.02 VALVE TAGS

A. Provide valve tags for all valves installed for this project. Valve tags shall be constructed of brass with stamped letters and service designation tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges, brass S hook.

B. Valve tags shall be permanently stamped and marked with a service designation, normal valve position, and an identifying number as large as possible. Each valve shall have a separate and distinct number coordinated with the service designations shown on the Drawings and the Owners existing valve numbering system. Coordinate with the Architect/Engineer and Owner before finalizing the valve tag numbering system.

2.03 STEAM TRAP TAGS

A. Provide steam trap tags for all steam traps installed for this project. Steam trap tags shall be constructed of brass with stamped letters and service designation tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges, brass S hook.

B. Each steam trap tag shall be permanently stamped and marked with a service designation and a unique identifying number as large as possible.

C. Each trap shall have a separate and distinct number coordinated with the service designations shown on the Drawings and the Owners existing trap numbering system. Coordinate with the Architect/Engineer and Owner before finalizing the trap tag numbering system.

2.04 PIPE MARKERS

A. All accessible piping installed indoors for this project, insulated and uninsulated shall be identified with wraparound pipe markers. Pipe markers shall be factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. “Accessible” piping shall include exposed piping, and piping located above lay-in ceilings. Markers shall include system name, flow arrow, and color code and pipe diameter.

B. All piping installed outdoors for this project, insulated and uninsulated, shall be identified with wraparound pipe markers. Pipe markers shall be factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. The marker shall be printed with weather-resistant ink.

C. Where pipes are too small or not readily accessible for application of pipe markers, a brass identification tag at least 1 ½ inches in diameter, with depressed ½ inch high black letters and numerals, shall be securely fastened at locations specified for pipe markers.

D. See pipe marker schedule for size requirements of pipe markers.

2.05 MECHANICAL EQUIPMENT MARKERS

A. Identify all mechanical equipment, bare or insulated, installed in the rooms or on the roof, by means of lettered and numbered nameplate (not stenciled) identifying the equipment and service. Refer to the Drawings for equipment identifications. Nameplates shall be aluminum with permanent 1 ½ inch high white letters on a black background, mechanically affixed and installed in a readily visible location on the equipment. Coordinate the final equipment designation with the Owner.

B. In addition to markers, all mechanical equipment shall be furnished with the manufacturer’s identification plate showing the name of equipment, manufacturer’s name and address, date of purchase, model number and performance data.

2.06 DUCT WORK IDENTIFICATION

A. Provide full air distribution system identification at each side of a wall penetration, in a mechanical room, at all changes in direction and at no more than 50 foot intervals. Provide arrows identifying direction of flow.

B. Fire damper or Smoke damper access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch in height reading: SMOKE DAMPER or FIRE DAMPER.

C. Identification shall be preprinted labels.

D. Letter Size: 1-1/2 inches in height.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Apply piping system markers and valve tags in the following locations:
   1. Adjacent to each valve and fitting.
   2. At each branch location and riser take-off
   3. At each side of a pipe passage through floors, walls, ceiling and partitions.
   4. At each pipe passage to and from underground areas.
   5. Every 20 feet on all horizontal and vertical pipe runs.

B. Provide arrow markers showing direction of flow incorporated into or adjacent to each piping system marker. Use double-headed arrows if flow is in both directions.

C. Apply all piping system markers where view is unobstructed; markers and legends shall be clearly visible from operating positions.

D. Apply all tags and piping system markers in accordance with the manufacturer's instructions. Do not attach tags to valve handle such that the normal or emergency operation of the valve will be hindered.

3.02 VALVE CHART

A. Provide valve and steam trap chart identifying each valve's and steam trap's number, size of valve and service.

B. Frame the chart and locate the schedule in the Mechanical Equipment Room. (Aluminum Frame with plastic window).

C. Provide a compact disc that has the valve and steam trap chart schedule in a spreadsheet format. The spreadsheet software to be used for the schedule shall be identified by the Owner.

3.03 LAY IN CEILING TILES AND ACCESS DOORS

A. Provide a lettered and numbered nameplate for each access door indicating the mechanical equipment that the door provides access too.

B. Where VAV boxes, hot water reheat coils, or other mechanical devices are installed above a lay-in ceiling tile system, provide and install color coded thumb tabs to mark the location of the equipment above the ceiling.

3.04 SCHEDULES

A. Pipe Marker Letter Size Schedule:

Outside diameter of insulation or pipe Inches	**Letter height Inches**	**Color field Inches**
3/4 to 1-1/4	1/2	8
1-1/2 to 2	3/4	8
2-1/2 to 6	1 - 1/4	12
8 to 10	2 - 1/2	24
Over 10	3 - 1/2	24

END OF SECTION 230555

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies requirements for testing, adjusting, and balancing of all air and hydronic fluid distribution systems, including the equipment and devices associated with each system.

B. The work includes setting speed and flow, adjusting equipment and devices installed for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to the mechanical installations specified in other Sections of the Specifications.

1.02 RELATED WORK

A. Drawings and general provisions of the Contract, including General Conditions, any Supplemental Conditions and Division 1 Specification Sections, govern the work of this section.

1.03 SUBMITTALS

A. Submit proof that the testing, adjusting and balancing agency meets the requirements of Section 1.04 “Quality Assurance”, and all other specified requirements.

B. Prior to performing the work, submit sample blank forms of the test reports that will be submitted by the entity performing work of this Section, indicating all data and parameters included.

C. Submit certified test reports, signed by the authorized representative of the testing and balancing agency. Certify the reports to be proof that the systems have been tested, adjusted and balanced in accordance with the selected reference standards (NEBB or AABC); are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at completion of the testing, adjusting and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Submittal of test report shall be in the following format:
   1. Draft Report: Upon completion of testing, adjusting and balancing procedures, prepare draft reports on the approved forms. Draft report may be handwritten, but must be complete, factual, accurate and legible. Organize and format draft reports in the same manner specified herein for the final reports. Submit two complete sets of draft reports. Only one complete set of draft reports will be returned.
   2. Final Report: Upon verification and approval of draft reports, prepare final reports, type written and organized and formatted as described herein. Submit two complete sets of final reports.
      a. Report Format: Submit reports using the standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted and balanced. Include schematic systems diagrams. Enclose the report contents in a 3-ring binder. Divide the contents into the below listed divisions, separating them by divider tabs with titles descriptive of the contents:
         1) General Information and Summary.
         2) Air Systems.
         3) Hydronic Systems.
      b. Report Contents: Provide the following minimum information, forms and data:
         1) General Information and Summary: Identify the testing, adjusting and balancing Agency, Contractor, Owner, Architect/Engineer, and Project on the inside cover sheet. Include addresses, and contact names and telephone numbers. Include a certification sheet containing the seal and name, address, telephone number and signature of the Agency’s responsible certified Test and Balance Engineer.

Include in this division a listing of the instrumentation used for the procedures, along with the proof of calibrations.

2) Include in the remainder of the reports the appropriate forms containing, as a minimum, the information indicated on the standard report forms prepared by AABC or NEBB, for each item of equipment and system. Prepare a schematic diagram for each item of equipment and system, to accompany each respective report form.

c. Calibration Reports: Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards within a period not exceeding six months prior to conducting the test procedures.

d. Existing Systems: Where existing systems are to be added to or modified include in the report results of operational tests taken prior to modifications including but not limited to existing fan and pump curves, pressure readings and flow measurements. Include in the report copies of the equipment and motor nameplate data along with equipment performance curves indicating operating points prior to any modifications and, where existing equipment is retained, operating points after system balance. Where terminals are adjusted or modified include terminal performance curves/data and final readings.

1.04 QUALITY ASSURANCE

A. Test, adjust and balance systems and equipment by using competent mechanics regularly employed by a testing, adjusting and balancing Subcontractor whose primary business is the testing, adjusting and balancing of building mechanical systems. The testing, adjusting and balancing Subcontractor shall be a business established for a minimum of 10 years.

B. The testing, adjusting, and balancing Subcontractor shall be certified by the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).

C. Instrumentation type, quantity, and accuracy shall be as described in AABC's "National Standards for Field Measurement and Instrumentation, or Total System Balance, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

D. All instrumentation shall be calibrated at least every 6 months or more frequently if required by the instrument manufacturer.

1.05 PERFORMANCE REQUIREMENTS

A. Comply with all applicable Federal, State and Local laws, ordinances, regulations and codes, and the latest industry standards including, but not limited to the entities listed below for procedures, measurements, instruments and test reports for testing, adjusting and balancing work:
   1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
   2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
   3. National Environmental Balancing Bureau (NEBB)
   4. Associated Air Balance Council (AABC)

B. Set the air delivery or intake of each diffuser, grille and register to be as designed or within five percent of the air flow rates shown on the Drawings.

C. Set the fan air flow rate and static pressure rise across the fan to be within 10 percent above the design value at design speed.

1.06 JOB CONDITIONS

A. Require the testing and balancing specialist to review his work with the respective manufacturers of the equipment and devices involved, and coordinate and schedule all work.

B. Furnish and install balancing dampers, pressure taps, gauges, valves, and other components as required for a properly balanced system, whether or not specified herein or shown on the Drawings, all at no additional cost to the Owner. Make all adjustment or replacement parts recommended by the testing and balancing specialist in strict accordance with the respective equipment manufacturer's recommendations.

C. Coordinate with the control manufacturer's representative to set the adjustment of the automatically operated dampers and control valves to operate as required.

1.07 GENERAL

A. The Owner will occupy the building during the entire testing, adjusting, and balancing period. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

B. Complete all tests specified herein to the satisfaction of the Architect/Engineer before final acceptance.

C. The Architect/Engineer, or his representative, is the sole judge of the acceptability of the tests. The Architect/Engineer may direct the performance of any such additional tests, as he deems necessary in order to determine the acceptability of the systems, equipment, material and workmanship. No additional payment will be made for any test required by the Architect/Engineer.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.

B. Obtain copies of approved shop drawings of all air handling and hydronic equipment, air outlets (supply, return and exhaust), manual valves, automatic valves and the temperature control diagrams, including intended sequence of operations.

C. Existing Systems: Where existing systems are to be added to or modified perform operational tests prior to modifications including but not limited to existing fans and pumps curves, pressure readings and flow measurements.
   1. Obtain copies of the equipment and motor nameplate data along with equipment performance curves indicating operating points prior to any modifications. Where terminal units are to be adjusted or modified obtain performance data for these units.

D. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, and is operable. Do not proceed with testing, adjusting and balancing until unsatisfactory conditions have been corrected in a manner approved by the testing and balancing specialist.

E. Examine the air systems to see that they are free from obstructions. Determine that all dampers and registers are open, moving equipment is lubricated, clean filters are installed, and automatic controls are functioning; and perform other inspections and maintenance activities necessary for proper operation of the systems.

F. Examine the hydronic systems to see that they are free from abnormal obstructions, and that all piping, valves and equipment have been properly made fully operational. Determine that all equipment and control systems are performing correctly by functional testing.

G. Where existing systems are to be modified or added to ensure that all strainers and filters are clean and any operational problems that will prevent system balance have been brought to the attention of the Owner and repaired.

3.02 TESTING, ADJUSTING AND BALANCING

A. Notify the Owner 48 hours in advance of starting any tests. Do not perform any tests until acknowledgment of notification and approval has been received from the Owner.

B. Provide all necessary instruments and personnel for the tests. If, in the opinion of the Architect/Engineer, the results of such tests show that the Work has not complied with the requirements of the Contract Documents, make all additions or changes necessary to put the system in proper working condition and pay all expenses for all subsequent tests which are necessary to determine whether the Work is satisfactory. Any additional work or subsequent tests shall be carried out at the convenience of the Architect/Engineer.

C. Test all packaged equipment in strict accordance with the equipment manufacturer's requirements.

D. Perform any and all other tests that may be required by the local municipality or other governing body, board or agency having jurisdiction.

E. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

F. Actuate all safety devices in a manner that clearly demonstrates their workability and operation.

G. Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of test procedure.

H. Perform tests and compile test data for all air systems and hydronic systems.

I. Include a schematic diagram locating the air inlets, outlets, fans, equipment, dampers and regulating devices for air systems, and a schematic diagram for location of balancing valves, flow indicators, equipment, and devices for hydronic systems.

J. All instruments used shall be provided by the entity performing the Work of this Section, and shall be accurately calibrated and maintained in good working order.

K. Air Systems

Perform the testing, adjusting and balancing of air systems in accordance with the detailed procedures outlined in the referenced standards; including but not be limited to the following:

1. Test, record and adjust fan rpm to design requirements.
2. Test and record motor full load amperes.
3. Make a pitot tube traverse of main supply ducts and obtain design flow rate at fans.

4. Test and record system static pressure, velocity pressure and total pressure.
5. Test and adjust system for design supply, transfer and return air flow rate.
6. Test and adjust system for minimum and maximum design flow rates of outside air.
7. Test and record return air temperatures.
8. Test and record coil and fan leaving air temperatures.
9. Adjust all main supply, return, relief, and exhaust air ducts to proper design flow rate.
10. Adjust all zones to proper design flow rate for supply, return, transfer, relief and exhaust air.
11. Test and adjust each diffuser, grille and register.
12. Identify each grille, diffuser and register as to location and area on the schematic diagram.
13. Identify and list in the final report size, type and manufacturer of diffusers, grilles and registers and all tested equipment. Use manufacturer's data on all equipment to make required calculations for testing, adjusting and balancing. Include design required velocity and test resultant velocity, required flow rate and test resultant flow rate after adjustment as part of readings and tests of diffusers, grilles and registers.
14. Adjust all diffusers, grilles and registers to minimize drafts in all areas.
15. Permanently mark all dampers after air balance is complete so that they can be restored to their correct position, if disturbed later.
16. Seal openings in ductwork for pitot tube insertion with snap-in plugs after air balance is complete.

L. Hydronic Systems
   1. Perform the testing, adjusting and balancing of hydronic systems in accordance with the detailed procedures outlined in the referenced standards; and including but not limited to the following:
      a. Preliminary procedure prior to balancing:
         1) Examine water in system and determine if water has been treated and cleaned.
         2) Check expansion tank to determine that it is not air bound and the system is completely full of water.
         3) Purge all air vents of water systems, check automatic air vents and determine if they are operating properly. Repair or replace any air vents that are not operating properly.
         4) Coordinate with control manufacturer for required cooling and heating temperature controls and corresponding, automatic valve operation settings.
         5) Open all normally open valves to full open position. Set automatic valves to full coil flow.
         6) Complete air balance before final water balance begins.
         7) Check water pumps for pump rotation and for proper flow rate delivery against manufacturer's pump curves.
         8) Set all balancing valves for required flow delivery at mains and branch mains to cooling and heating elements.
         9) Upon completion of flow readings and adjustments of balancing valves, mark all settings and record data, so that they can be restored to their correct "balanced" position, if disturbed later.
      b. Include the following as part of the final balancing:
         1) After required cooling and heating temperature controls and automatic valve operation settings are made, recheck pump flow requirements and readjust system as required.
         2) Record pressure drop through coil at set flow rate of coil for full cooling and for full heating. Set pressure drop across bypass valve to match coil pressure drop.
         3) Record and check the following items at each cooling and heating element:
         4) Inlet water temperatures and static pressure at connections.
         5) Leaving water temperatures and pressure drop of each coil.
         6) Flow rate through coil with control valve stroked manually wide open.

7) Record operating suction and discharge pressures of each pump and final total dynamic head and rated amperage versus actual amperage of pump motors.
8) Record entering and leaving water temperatures and flow through all equipment and devices.
9) Check and record all flow rates at all locations in the piping system with flow meters.
10) Upon completion of air and hydronic systems testing, patch insulation, ductwork and housings, using materials identical to those removed.
11) Perform final testing, adjusting and balancing during summer season for air conditioning systems and during winter season for heating systems, including operation when outside conditions are within 5 degrees F wet bulb temperature of maximum summer design condition, and within 10 degrees F dry bulb temperature of minimum winter design condition.
12) Retest, adjust, and balance systems subsequent to system modifications. Resubmit test results.

END OF SECTION 230594

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section describes the insulation, jackets and accessories for piping as scheduled in Part 3 of this Section and as shown on the Drawings.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping

B. Section 078413 - Through Penetration Firestopping for HVAC Systems

C. Section 079201 - Non Fire Rated Sleeves and Seals

D. Section 232000 - Pipe, Valves, and Fittings

E. Section 232300 - Refrigerant Piping

1.03 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 255 - Surface Burning Characteristics of Building Materials.

B. New York:
   1. International Energy Conservation Code - 2018
   2. International Mechanical Code - 2018
   3. Mechanical Code of New York State - 2020
   4. Energy Conservation Construction Code - 2020
   5. ASHRAE 90.1 - 2016

C. New Jersey - Energy Subcode (NJAC 5:23-3.18):
   1. International Energy Conservation Code/2021 (Low-Rise Residential)
   2. ASHRAE 90.1-2019 (Commercial & all other Residential)

D. Greenguard

E. Underwriters Laboratories, Inc. (UL):
   1. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

F. American Society for Testing and Materials (ASTM):
   1. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   2. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   3. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   4. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
   5. ASTM C335 - Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation.
   6. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
   7. ASTM C518 - Standard Test Method for Steady-State Heat Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   8. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.

9. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
10. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.
11. ASTM C 552 - Standard Specification for Cellular Glass Thermal Insulation
12. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
13. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
14. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing.
15. ASTM C 591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
16. ASTM C 610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
17. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
18. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
19. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
20. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
21. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
22. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
23. ASTM E96 - Standard Test Method for Water Vapor Transmission of Materials.

1.04 DEFINITIONS

A. Greenguard: Greenguard Environmental Institute

B. IAQ: Indoor Air Quality

C. EPA: Environmental Protection AgencyA

D. WHO: World Health Organization

E. ASJ: All Service Jacket

F. SSL: Self-Sealing Lap

G. FSK: Foil-Scrim-Kraft; jacketing

H. PSK: Poly-Scrim-Kraft; jacketing

I. PVC: Polyvinyl Chloride

J. FRP: Fiberglass Reinforced Plastic

K. Cold Service Piping/ Surfaces: Pipes or surfaces where the normal operating temperature is 60 degrees F or lower.

L. Hot Service Piping/ Surfaces: Pipes or surfaces where the normal operating temperature is 105 degrees F or higher.

1.05 SUBMITTALS

A. Product data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified with minimum 3 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.

B. Materials:
   1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
   2. Insulation for duct, pipe and equipment for above grade exposed to weather outside building shall be certified as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D1692.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Follow manufacturer's recommended storage and handling practices.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product (tapes, adhesives, mastics, cements, insulation, etc.).

B. Maintain temperature before, during, and after installation for a minimum of 24 hours.

C. Supply fiberglass products that assure excellent IAQ (Indoor Air Quality) performance through Greenguard Certification.

D. Mold: Carefully inspect any insulation that has been exposed to water. If it shows any sign of mold growth remove it from the Site. If the material is wet but shows no sign of mold, dry rapidly and thoroughly. If it shows signs of facing degradation from wetting remove it from the Site.

PART 2 - PRODUCTS

2.01 FIBER GLASS INSULATION

A. Approved Manufacturers:
   1. Knauf Insulation
   2. Johns Manville Corporation
   3. Owens Corning Corporation
   4. CertainTeed Corporation

B. Fiber glass insulation meeting ASTM C547, ASTM C585, and ASTM C795; rigid molded, noncombustible.

C. Factory applied vapor barrier jacket: ASJ/SSL conforming to ASTM C1136 Type I and ASTM E96, secured with self-sealing longitudinal laps and butt strips.

2.02 FIBER GLASS INSULATION JACKETS AND ACCESSORIES

A. Field-Applied Jackets and Fitting Covers
   1. PVC - 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white or colored. Fitting cover system consisting of pre-molded, high-impact PVC materials with fiber glass inserts. Approved Manufacturer: Proto Corporation.
      a. Thickness: 10 mil.
      b. Closures: stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
   2. ASTM B209 formed aluminum, 0.016-inch thick in smooth, corrugated, or embossed finish with factory-applied moisture barrier. Approved Manufacturer: Childers.
      a. Overlap: 2-inch minimum.
      b. Fittings: 0.016-inch thick die-shaped with factory-applied moisture barrier.
      c. Metal jacket bands: 3/8-inch wide, 0.015-inch thick aluminum or 0.010-inch thick stainless steel.
   3. ASTM A666, Type <<302; 304; 316>> stainless Steel, 0.010-inch thick in smooth, corrugated, or embossed finish with factory-applied moisture barrier. Approved Manufacturer: Childers.
      a. Overlap: 2-inch minimum.
      b. Fittings: 0.016-inch thick die-shaped with factory-applied moisture barrier.
      c. Metal jacket bands: 3/8-inch wide, 0.010-inch thick stainless steel.
   4. Laminated Self-Adhesive Water and Weather Seals - Permanent acrylic self-adhesive System; weather resistant, high puncture and tear resistance; meeting or exceeding requirements of UL 723; applied in strict accordance with manufacturers' recommendations.

B. Fitting Insulation
   1. Pre-formed fiberglass, preformed perlite, mitered fiberglass, mitered perlite or calcium silicate in lieu of PVC systems. Protect fittings with field-applied fitting covers.

C. Tapes
   1. Vapor barrier type, self-sealing, non-corrosive, fire-retardant. Approved Manufacturer: Compac Corporation

2.03 ELASTOMERIC INSULATION

A. Approved Manufacturers:
   1. Armacell LLC
   2. K-Flex USA, Inc.

B. Flexible, tubular (Type 1) or sheet/roll form (Type 2) closed-cell elastomeric insulation complying with ASTM C534 <<Grade 1 - Standard (temperature range -297°F to 220°F); Grade 2 - High Temperature (to 350°F); Grade 3 - Contains no halogens>>; use molded tubular material wherever possible.

2.04 ELASTOMERIC INSULATION ACCESSORIES

A. Adhesives:

1. Air dried, waterproof vapor barrier contact adhesive, compatible with insulation for joining of seams and butt joints.

B. Finishes:
1. Provide a weather and UV resistant protective finish for outdoor applications in accordance with the manufacturer's recommendations.

2.05 CELLULAR GLASS INSULATION

A. Approved Manufacturers:
1. Pittsburgh Corning Corporation

B. Cellular glass insulation meeting ASTM C552, Type II.

2.06 CELLULAR GLASS INSULATION ACCESSORIES

A. Field-Applied Jackets and Fitting Covers:
1. ASTM B209 formed aluminum, 0.016-inch thick in smooth, corrugated, or embossed finish with factory-applied moisture barrier. Approved Manufacturer: Childers.
a. Overlap: 2-inch minimum.
b. Fittings: 0.016-inch thick die-shaped with factory-applied moisture barrier.
c. Metal jacket bands: 3/8-inch wide, 0.015-inch thick aluminum or 0.010-inch thick stainless steel.
2. ASTM A666, Type <<302; 304; 316>> stainless Steel, 0.010-inch thick in smooth, corrugated, or embossed finish with factory-applied moisture barrier. Approved Manufacturer: Childers.
a. Overlap: 2-inch minimum.
b. Fittings: 0.016-inch thick die-shaped with factory-applied moisture barrier.
c. Metal jacket bands: 3/8-inch wide, 0.010-inch thick stainless steel.
3. Laminate: Factory applied vapor retarder jacket: ASJ/SSL conforming to ASTM C 1136 Type I, secured with self-sealing longitudinal laps and butt strips.

B. Adhesives:
1. Two component adhesive for adhering cellular glass insulation to itself or to other porous or nonporous substrates. Approved products: PC 88 Adhesive by Pittsburgh-Corning.

C. Joint Sealants:
1. Styrenebuadiene rubber sealant, stainless steel compatible. Approved products: Pittseal 727 Sealant by Pittsburgh-Corning.

D. Coatings:
1. Vapor and weather barrier acrylic latex coating. Approved products: Pittecote 404 Coating by Pittsburgh-Corning.
2. Vapor and weather barrier asphalt coating. Approved Products: Pittecote 300 Coating by Pittsburgh-Corning.

2.07 HIGH DENSITY JACKETED INSULATION INSERTS FOR HANGERS AND SUPPORTS

A. For use with Fiberglass Insulation:
1. Cold Service Piping:
a. Polyurethane Foam: Minimum density 4 pcf, K of 0.13 at 75 degrees F, minimum compressive strength of 125 psi.
2. Hot Service Piping:
a. Calcium Silicate: Minimum density 15 pcf, K of 0.50 at 300 degrees F; ASTM C 533.
b. Perlite: Minimum density 12 pcf, K of 0.60 at 300 degrees F; ASTM C 610.

B. For Use with Flexible Elastomeric Foam Insulation: Hardwood dowels and blocks, length or thickness equal to insulation thickness, other dimensions as specified or required.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that all piping is tested and approved prior to insulation installation.

B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 INSTALLATION (GENERAL)

A. Install all materials using skilled labor regularly engaged in this type of work. Install all materials in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. Extend all surface finishes in such a manner as to protect all raw edges, ends and surfaces of insulation.

C. On cold surfaces where a vapor retarder must be maintained, apply insulation with a continuous, unbroken moisture and vapor seal. Insulate and vapor seal all hangers, supports, anchors, or other projections secured to cold surfaces to prevent condensation.

D. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. For hot piping conveying fluids <<140°F>> or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. For hot piping conveying fluids over <<140°F>>, insulate flanges and unions at equipment.

G. Maintain continuous pipe insulation through walls, ceiling or floor openings, or sleeves except where firestop or firesafing materials are required.

H. Install insulation neatly, accurately and without voids, in accordance with manufacturer's instructions and NIAC National Commercial and Industrial Insulation Standards.

I. Insulate fittings, valves and flanges using premolded covers with precut insulation inserts.

J. Insulate piping using insulation of type and thickness scheduled in this Section.

K. Install metal shields between hangers or supports and the piping insulation. Install rigid insulation inserts as required between the pipe and the insulation shields. Fabricate inserts to be of equal thickness to the adjacent insulation and vapor seal as required. Insulation inserts shall be no less than the following lengths:

1½" to 2½" IPS	10" long
3" to 6" IPS	12" long
8" to 10" IPS	16" long
12" and over IPS	22" long

L. Pipe exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor) to be finished with PVC jacket and fitting covers, aluminum jacket, or stainless steel jacket.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with <<aluminum; stainless steel>> jacket with seams located on bottom side of horizontal piping. Coordinate insulation installation with heat-tracing installation and testing. Insulate piping after tracing or heat distribution tape has been installed and tested for continuity.

3.03 INSTALLATION (FIBER GLASS)

A. Provide a continuous vapor retarder on piping operating below ambient temperatures. Seal all joints, seams and fittings.

B. Firmly butt and secure ends with appropriate butt-strip material. On high-temperature piping, double layering with staggered joints when recommended by the insulation manufacturer. When double layering, the inner layer should not be jacketed.

C. Insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

D. Insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. Exterior Applications:
   1. Jacket piping and fittings exposed to the elements using aluminum or stainless steel jackets with a factory applied moisture barrier. Hold firmly in place with a friction type Z lock or a minimum 2” overlap joint. Seal all joints completely along the longitudinal seam and install so as to shed water. Seal all circumferential joints by use of preformed butt strips; minimum 2" wide or a minimum 2" overlap. Overlap butt strips to the adjacent jacketing a minimum ½-inch and completely weather seal. Install a 6" to 10" unsealed slide joint every 25 to 30 lineal feet to allow for the thermal expansion of the pipe and jacketing. In addition, apply a thin bead of silicone grease in the overlap to prevent water migration while allowing the joint to slide. Install an unsealed slide joint where distance between fittings exceeds 8 lineal feet.
   2. Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness ad adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with <<aluminum; stainless steel>> jacket with seams located on bottom side of horizontal piping.

F. Cold Piping Insulation:

1. On below freezing applications and in high abuse areas protect the ASJ jacket with a PVC vapor retarding outer jacket. Seal exposed ends of the insulation with a vapor retarder mastic installed per the manufacturer's recommendations. Apply vapor seals at butt joints at every fourth pipe section joint and at each fitting to isolate any water incursion.
2. On chilled water systems operating in conditions of: RH of 90% and above, follow the same guidelines as described above for below freezing applications.

3.04 INSTALLATION (ELASTOMERIC)

A. Piping:
   1. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, slide unslit sections over the open ends of piping or tubing. Adhere and seal all seams and butt joints using adhesive.
   2. Push insulation onto the pipe, never pull. Stretching of insulation may result in open seams and joints.
   3. Tape the ends of the tubing before slipping the insulation over the new pipes to prevent dust from entering the pipe.
   4. Clean cut all edges. Do not leave rough or jagged edges of the insulation. Use proper tools such as sharp non-serrated knives.
   5. On cold piping, adhere insulation directly to the piping at the high end of the run using a two-inch strip of adhesive on the inner diameter of the insulation and on the pipe. Coat all exposed end cuts of the insulation with adhesive. Adhere all penetrations through the insulation and termination to the substrate to prevent condensation migration.
   6. Use sheet insulation on all pipes larger than 6-inch diameter. Do not stretch insulation around the pipe. On pipes larger than 12-inch diameter, adhere insulation directly to the pipe on the lower 1/3 of the pipe. On pipes greater than 24-inch diameter, completely adhere insulation.
   7. Stagger seams when applying multiple layers of insulation.

B. Valves, Flanges and Fittings:
   1. Insulate all fittings with the same insulation thickness as the adjacent piping. Adhere all seams and mitered joints with adhesive. Sleeve screwed fittings and adhere with a minimum 1" overlap onto the adjacent insulation.
   2. Insulate valves, flanges, strainers, and Victaulic couplings using donuts covered with sheet or oversized tubular insulation.

C. Hangers:
   1. Support piping system using high density inserts with sufficient compressive strength. Apply elastomeric foam insulation with the same or greater thickness than the pipe insulation to pipe supports. Seal all joints with adhesive.
   2. Standard and split hangers - Insulate piping supported by ring hangers with the same insulation thickness as the adjacent pipe. Seal all seams and butt joints with adhesive. Sleeve ring hangers using oversized tubular insulation. On cold piping, extend insulation up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.
   3. Clevis hangers or other pipe support systems - Install saddles under all insulated lines at unistrut clamps, clevis hangers, or locations where insulation may be compressed due to the weight of the pipe. Insert and adhere wooden dowels or blocks of a thickness equal to the insulation to the insulation between the pipe and the saddle.
   4. Pre-insulated pipe hangers can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. Adhere a pair of non-skid pads to the clamps to minimize the movement. In addition, to prevent loosening of the clamps, use an antivibratory fastener, such as a nylon-locking nut.

D. Exterior Applications:

1. Paint all outdoor exposed piping with two coats of UV resistant finish. Prior to applying the finish, wipe the insulation with denatured alcohol. Do not tint the finish.
2. Locate seams for all outdoor exposed piping on the lower half of the pipe.

3.05 INSTALLATION (CELLULAR GLASS)

A. Apply cellular glass insulation in a single layer where thickness permits. Seal joints with joint sealant. Secure inner layers of insulation with fiber-reinforced tape. Secure the outermost layer of insulation with metal bands of appropriate width and thickness, two bands per insulation section.
   1. Finish:
      a. Outdoor Applications - field applied metal jacket.
      b. Indoor Applications - factory applied ASJ.

B. Consult the manufacturer's installation instructions for additional information.

C. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness ad adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with <<aluminum; stainless steel>> jacket with seams located on bottom side of horizontal piping.

3.06 PIPING INSULATION MATERIAL SCHEDULE

SYSTEM OR SERVICE	LOCATION	INSULATION TYPE	JACKET
HEATING HOT WATER	INSIDE	FIBER GLASS	ALL SERVICE JACKET
HEATING HOT WATER	INSIDE	FIBER GLASS	ALL SERVICE JACKET
HEATING HOT WATER	OUTSIDE	FIBER GLASS	ALUMINUM JACKET
HEATING HOT WATER	OUTSIDE	FIBER GLASS	ALUMINUM JACKET
CHILLED WATER	INSIDE	CELLULAR GLASS	ALL SERVICE JACKET
CHILLED WATER	INSIDE	CELLULAR GLASS	ALL SERVICE JACKET
CHILLED WATER	OUTSIDE	CELLULAR GLASS	ALUMINUM JACKET
CHILLED WATER	OUTSIDE	CELLULAR GLASS	ALUMINUM JACKET
CONDENSATE DRAINS	INSIDE	ELASTOMERIC	
HVAC REFRIGERANT LINES	INSIDE	ELASTOMERIC	
HVAC REFRIGERANT LINES	OUTSIDE	ELASTOMERIC	EXTERIOR COATING
STEAM (LPS) TO 15 PSIG.	INSIDE	FIBER GLASS	ALL SERVICE JACKET
STEAM (LPS) TO 15 PSIG.	INSIDE	FIBER GLASS	ALL SERVICE JACKET
STEAM CONDENSATE	INSIDE	FIBER GLASS	ALL SERVICE JACKET
STEAM CONDENSATE	INSIDE	FIBER GLASS	ALL SERVICE JACKET
STEAM CONDENSATE	OUTSIDE	FIBER GLASS	ALUMINUM JACKET
STEAM CONDENSATE	OUTSIDE	FIBER GLASS	ALUMINUM JACKET
DOMESTIC COLD WATER	INSIDE	FIBER GLASS	ALL SERVICE JACKET
DOMESTIC HOT WATER	INSIDE	FIBER GLASS	ALL SERVICE JACKET

3.07 MINIMUM PIPING INSULATION THICKNESS (IN.)

FLUID OPERATING TEMP. RANGE (°F)	SYSTEMS IN TEMP. RANGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (IN.)				
		CONDUCTIVITY BTU*IN./(H*SQ. FT.*°F)	MEAN RATING TEMP (°F)	<1	1 TO < 1-1/2	1-1/2 TO < 4	4 TO < 8	=8
> 350		0.32-0.34	250	4.5	5.0	5.0	5.0	5.0

251-350		0.29-0.32	200	3.0	4.0	4.5	4.5	4.5
201-250		0.27-0.30	150	2.5	2.5	2.5	3.0	3.0
141-200		0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
105-140		0.21-0.28	100	1.0	1.0	1.5	1.5	1.5
40-60		0.21-0.27	75	0.5	0.5	1.0	1.0	1.0
< 40		0.20-0.26	50	0.5	1.0	1.0	1.0	1.5

END OF SECTION 230700

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section describes the insulation, jackets and insulating accessories for sheet metal ductwork as scheduled in Part 3 of this Section and as shown on the Drawings.

1.02 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 255 - Surface Burning Characteristics of Building Materials.

B. New York:
   1. International Energy Conservation Code - 2018
   2. International Mechanical Code - 2018
   3. Mechanical Code of New York State - 2020
   4. Energy Conservation Construction Code - 2020
   5. ASHRAE 90.1 - 2016

C. New Jersey - Energy Subcode (NJAC 5:23-3.18):
   1. International Energy Conservation Code/2021 (Low-Rise Residential)
   2. ASHRAE 90.1-2019 (Commercial & all other Residential)

D. Greenguard

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):

F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

G. Underwriters Laboratories, Inc. (UL):
   1. UL 723 - Surface Burning Characteristics of Building Materials.

H. American Society for Testing and Materials (ASTM):
   1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM C177 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
   3. ASTM C518 - Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   4. ASTM C553 - Mineral Fiber Blanket and Felt Insulation.
   5. ASTM C612 - Specification for Mineral Fiber Block and Board Thermal Insulation.
   6. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel
   7. ASTM C921 - Properties of Jacketing Materials for Thermal Insulation.
   8. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation
   9. ASTM D1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
   10. ASTM E84 - Surface Burning Characteristics of Building Materials.
   11. ASTM E96 - Water Vapor Transmission of Materials.

1.03 DEFINITIONS

A. Greenguard: Greenguard Environmental Institute

B. IAQ: Indoor Air Quality

C. EPA: Environmental Protection Agency

D. WHO: World Health Organization

E. ASJ: All Service Jacket

F. SSL: Self-Sealing Lap

G. FSK: Foil-Scrim-Kraft; jacketing

H. PSK: Poly-Scrim-Kraft; jacketing

I. PVC: Polyvinyl Chloride

J. FRP: Fiberglass Reinforced Plastic

K. Cold Piping/Ductwork/Surfaces: Pipes or surfaces where the normal operating temperature is 60 degrees F or lower.

1.04 SUBMITTALS

A. Product data: To include product description, manufacturer's installation instructions, types and recommended thicknesses for each application, and location of materials.

B. Provide samples and mock-ups of systems as required.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of tapes, adhesives, mastics, cements, and insulation materials.

B. Follow manufacturer’s recommended handling practices.

C. Supply fiberglass products that assure excellent IAQ (Indoor Air Quality) performance through Greenguard Certification.

D. Mold: Carefully inspect any insulation that has been exposed to water. If it shows any sign of mold growth remove it from the Site. If the material is wet but shows no sign of mold, dry rapidly and thoroughly. If it shows signs of facing degradation from wetting remove it from the Site. Discard air handling insulation used in the air stream if exposed to water.

1.06 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing Products specified with minimum 3 years documented experience.
   2. Installer: Company specializing in performing the Work of this Section with minimum 3 years documented experience.

B. Materials:
   1. Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E84, NFPA 255 and UL 723.
   2. Certify insulation for duct, pipe and equipment for above grade exposed to weather outside building as being self-extinguishing for 1" thickness in less than 53 seconds when tested in accordance with ASTM D1692.

PART 2 - PRODUCTS

2.01 FIBERGLASS DUCT WRAP

A. Flexible Fiber Glass Blanket meeting ASTM C553 Types I, II and III, and ASTM C1290; Greenguard compliant.

B. Factory Applied Vapor Retarder Jacket: FSK or PSK conforming to ASTM C1136 Type II.

C. Maximum service temperature of 250º F (Faced) or 350° F (Unfaced).

D. Density:
   1. Concealed areas: Minimum 0.75 PCF.
   2. Exposed areas: Minimum 1.0 PCF.

E. Approved Products:
   1. Friendly Feel Duct Wrap by Knauf

2.02 FIBERGLASS RIGID BOARD

A. Rigid Fiber Glass Board insulation meeting ASTM C612 Type IA and IB.

B. Mean temperature by ASTM C177 and a maximum service temperature of 450º F.

C. Factory Applied Vapor Retarder Jacket: ASJ conforming to ASTM C1136 Type I, or FSK or PSK conforming to ASTM C1136 Type II.

D. Density:
   1. Concealed areas: Minimum 3 PCF
   2. Exposed areas: Minimum 6 PCF

E. Approved Products:
   1. Insulation Board by Knauf

2.03 ACOUSTIC DUCT LINER

A. Conforming to ASTM C1071 Type 1 and NFPA 90A & 90B.

B. Noise Reduction Coefficient (NRC): ASTM C423 Type A Mounting, 0.40 or higher for ½" product, 0.60 or higher for 1" product.

C. Rated for a maximum air velocity of 6000 Feet per minute.

D. Approved Products:
   1. Textile Duct Liner with HydroshieldÔ Technology by Knauf.

2.04 FIBERGLASS INSULATION ACCESSORIES

A. Aluminum Jacket - 0.016-inch (0.406 mm) thick in smooth, corrugated, or embossed finish with factory applied moisture barrier. Overlap 2-inch (50 mm) minimum.

B. Laminated Self-Adhesive Water and Weather Seals - apply per manufacturers' recommendations.

C. Tapes - Vapor barrier type, self-sealing, non-corrosive, fire-retardant. Approved Manufacturer: Compac Corporation

D. Adhesives - Approved Manufacturer: Foster

E. Mastic - Approved Manufacturer: Foster

F. Vapor Barrier Coating - Approved Manufacturer: Foster

2.05 SHEET WATERPROOFING MEMBRANE

A. Prefabricated, self-adhering, sheet-type waterproofing membrane shall be FlexClad-400 by MFM Building Products Corp. or approved equal.

B. Description:
   1. Top Layer: Stucco-embossed, UV-resistant aluminum weathering surface.
   2. Middle Layer: Multiple layers of high-density cross-linked polymer film.
   3. Bottom Layer: Uniform layer of rubberized asphalt adhesive, protected by disposable silicone release paper.

C. Color: As selected by Architect/Engineer.

D. Material Thickness: ASTM D1970/D1970M, 40 mils Nominal

E. Flexibility: ASTM D1970/D1970M, Pass.

F. Vapor Permeance: ASTM E96/E96M, 0 perms.

G. Nail Sealability: ASTM D1970/D1970M, Pass.

H. Heat Aging: ASTM D 794, Pass.

I. Tear Resistance: ASTM D 1424, Average: 660 grams.

J. Ultimate Elongation MD: ASTM D412, 434 percent.

K. Ultimate Elongation CMD: ASTM D412, 246 percent.

L. Low Temperature Flexibility: 1,000,000 Cycles at -10 Degrees F, 1,200 Cycles at -20 Degrees F, No cracking.

M. Flame Spread Index: ASTM E84, 0.

N. Smoke Density Index: ASTM E84, 5.

O. Wind-Driven Rain: SFBC TAS-110-95, 100 mph, No leakage or failure.

P. UV Stability: Excellent.

Q. Accessories: MFM Spray Adhesive

2.06 FIRE RATED BLANKET (KITCHEN HOOD EXHAUST DUCT)

A. Thermal Material: 2192°F rated core blanket, manufactured from calcium magnesium silicate.

B. Fully encapsulated thermal material in fiberglass reinforced aluminum/polypropylene scrip (FSP).
   1. Encapsulation FSP marked with UL Classification Mark.
   2. Encapsulation FSP marked with ICC-ES report number ESR 2213.
   3. Collars supplied in 6 inch wide by 25 feet long rolls.

C. Product Characteristics:
   1. Thickness: 1-1/2 inch.
   2. Nominal Density: 6 pcf.
   3. R-Value: 7.35 per layer when tested in accordance with ASTM C518 at 75°F.
   4. Flame Spread: <25 when tested in accordance with ASTM E84.
   5. Smoke Spread: <50 when tested in accordance with ASTM E84.

D. Approved Products:
   1. FireMaster FastWrap XL by Thermal Ceramics.

2.07 FIRE RATED BLANKET INSULATION ACCESSORIES

A. Glass Filament Tape: Minimum ¾ inch wide - used to temporarily secure blanket until permanent attachment using steel banding and/or steel insulation pins.

B. Aluminum Foil Tape: Minimum 3 inches used to seal cut edges.

C. Carbon Steel or Stainless Strapping Material Minimum: ½ inch wide and 0.015 inch thick.

D. Steel Insulation Pins: Minimum 12 gauge, length sufficient to penetrate through duct wrap insulation.

E. Insulation Clips: Galvanized steel, minimum 1-1/2 inches round or square.

F. Through Penetration Firestop Sealants:
   1. Packing Material: Remove encapsulation material from wrap, use core blanket (white) as penetration packing material.
   2. Firestop sealants per applicable building code report and/or laboratory design listings.

G. Grease and HVAC Duct Access Doors:
   1. Thermal Ceramics FastDoor XL Access doors

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that all ductwork is tested and approved prior to insulation installation.

B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.02 DUCTWORK REQUIRING INSULATION

A. Insulate Ductwork as specified in the DUCTWORK INSULATION SCHEDULE.
   1. Insulate any additional ductwork or plenums indicated to be insulated on the Drawings.

3.03 INSTALLATION (GENERAL)

A. Install all materials using skilled labor regularly engaged in this type of work. Install all materials in strict accordance with manufacturer's recommendations, building codes, and industry standards.

B. Locate insulation and cover seams in the least visible location. Extend all surface finishes in such a manner as to protect all raw edges, ends and surfaces of insulation.

C. On cold surfaces where a vapor retarder must be maintained, apply insulation with a continuous, unbroken moisture and vapor seal. Insulate and vapor seal all hangers, supports, anchors, or other projections secured to cold surfaces to prevent condensation.

D. Install insulation neatly, accurately and without voids, in accordance with manufacturer's instructions and NIAC National Commercial and Industrial Insulation Standards.

E. Install ductwork hanger supports on the outside of the insulation. Where vertical ducts are supported to the building structure, insulate the ductwork supports to prevent condensation.

F. Insulate ductwork using insulation of the type and thickness scheduled at the end of this Section.

G. If specified insulation board thickness does not cover ductwork standing seams and reinforcing angles, insulate them by adhering a grooved strip of fiberglass board with a thickness at least 1 ½ inches greater than the height of the seam or angle covered over the standing seam or angle.

3.04 ACOUSTIC DUCT LINER

A. Apply Duct Lining in strict accordance with the latest edition of SMACNA's "HVAC Duct Construction Standard Metal & Flexible" and NAIMA's "Fibrous Glass Duct Liner Standard".

B. Select length of mechanical fasteners in accordance with the manufacturer's recommendation as listed on each product. Install mechanical fasteners perpendicular to the duct surface, and such that the pin does not compress the liner more than 1/8 inch relative to the nominal thickness of the insulation.

C. Adhesive shall conform to ASTM C916. Apply adhesive to the sheet metal with a 90% minimum coverage. Coat all exposed edges of the duct liner with the same adhesive. Repair all rips and tears using an adhesive that conforms to ASTM C916.

D. Cover all internal duct areas with duct liner. Firmly butt transverse joints with no gaps and coat with adhesive. Overlap and compress longitudinal corner joints.

E. When air velocities are 4000 to 6000 FPM, apply metal nosing to all upstream transverse edges to additionally secure the insulation.

3.05 FIBERGLASS WRAP INSULATION

A. Apply external duct wrap per insulation schedule even where internally lined.

B. Install Duct Wrap to obtain specified R-value using a maximum compression of 25%.

C. Firmly butt all joints.

D. Overlap the longitudinal seam of the vapor retarder a minimum of 2 inches.

E. Where vapor retarder performance is required, repair all penetrations and damage to the facing using pressure-sensitive foil tape or mastic prior to system startup.

F. Use pressure-sensitive foil tapes a minimum 3 inches wide and apply by moving pressure using a squeegee or other appropriate sealing tool.

G. Additionally secure Duct Wrap to the bottom of rectangular ductwork over 24 inches wide using mechanical fasteners on 18-inch centers. Do not over-compress insulation during installation.

H. Overlap unfaced Duct Wrap a minimum of 2 inches and fasten using 4-inch to 6-inch nails or skewers spaced 4 inches apart, or secured with a wire/banding system. Do not damage the Duct Wrap.

3.06 FIBERGLASS BOARD INSULATION

A. Fit insulation by scoring, cutting and mitering to fit the contour of the ductwork.

B. Attach insulation to ductwork in thickness scheduled by brushing adhesive uniformly on all sides of ductwork covering 100 percent of ductwork surface. Press insulation into place, making complete contact with adhesive. Butt edges of insulation board tightly together without gaps.

C. Additionally, hold insulation in place by impaling on pins welded to all four sides of the ductwork. Locate and weld pins a minimum 12 inch on center with a minimum of 2 rows per side of duct and no less than 3 inches from the edges of the ductwork. Secure insulation to pins with 1 inch diameter hold-down washers. As an alternate to welded pins, provide “Gripnail” mechanical surface fasteners by Gripnail Corporation using pneumatic hammer designed for this work.

D. Seal all joints, seams, breaks, and punctures in facing with adhesive and cover with 3 inch wide sealing tape. Flash supports with vapor barrier coating.

E. For rectangular ducts and plenums exposed to weather, pitch ductwork or insulation board minimum ¼ inch per foot to prevent rainwater from accumulating on top of duct or plenum. Cover insulation board with Sheet Waterproofing Membrane.

3.07 SHEET WATERPROOFING MEMBRANE

A. Surface Preparation:
   1. Prepare surfaces in accordance with manufacturer’s instructions.
   2. Ensure tops of ducts have sufficient slope to eliminate ponding water.
   3. Ensure bottoms of ducts have foil-faced rigid insulation boards installed.
   4. Ensure surfaces are clean and dry.
   5. Remove dirt, dust, oil, grease, hand oils, processing lubricants, moisture, frost, and other contaminants that could adversely affect adhesion of waterproofing membrane.
   6. Prime metal, concrete, and masonry surfaces with primers approved by waterproofing membrane manufacturer.

B. Application:
   1. Apply waterproofing membrane in accordance with manufacturer’s instructions on all exterior insulated ductwork and at locations indicated on the Drawings.
   2. Apply membrane to clean, dry, primed metal ductwork and foil-faced rigid insulation boards. Do not apply over wet or non-rigid insulation.
   3. Apply membrane in accordance with manufacturer’s air, material, and surface temperature requirements.
   4. Apply firm, uniform pressure with hand roller to entire membrane to ensure proper adhesion. Concentrate pressure at seams and on underside of ductwork.

5. Apply membrane to ducts in accordance with manufacturer's instructions.
6. Apply membrane shingle fashion to shed water over, not against laps.
7. Do not terminate membrane on bottom of duct.
8. Apply minimum 3-inch laps and minimum 6-inch end laps for ductwork applications.
9. Embed membrane to bottom of ducts over 24 inches wide in light continuous layer of adhesive applied to insulation face.
10. Apply membrane to bottom of insulated ducts over 36 inches wide using mechanical attachment, in addition to adhesive, in accordance with manufacturer's instructions. Install pints on 12-inch centers with rows staggered.
11. Apply adhesive to areas where special adhesion requirements exist, including duct bottoms, flashings, transitions, joints, elbows, valves, tees, and other fittings.

C. Protection:
1. Protect applied waterproofing membrane and fabric flexible duct connections from damage during construction.

3.08 FIRE RATED BLANKET

A. Install insulation in direct contact with the ductwork in accordance with the manufacturer's instructions and referenced standards.

B. Install 2 layers of FireMaster FastWrap XL for zero clearance and a 1 and 2 hour commercial kitchen grease duct application per ASTM E2336.
1. Consult with manufacturer of proposed substitutions for required thickness to maintain a 2-hr fire rating with a zero clearance to combustibles.

C. Install 1 layer of FireMaster FastWrap XL for a 1 and 2 hour air ventilation duct enclosure per ISO 6944-1985.

D. Where exhaust duct penetrates firewall install ductwrap as per the manufacturer's instructions for through penetrations.

E. Locate doors on 20-foot centers on straight runs of ductwork and at each change of direction. Position doors on the side of duct a minimum of 1.5 inches above the bottom of the duct.

3.09 DUCTWORK INSULATION SCHEDULE

A. Fiber Glass Insulation Schedule:

Ductwork System	Type	Minimum R-Value
Supply Ducts and Plenums, Concealed	Fiberglass Duct Wrap	6
Return Ducts and Plenums, Concealed	Fiberglass Duct Wrap	6
Supply and Return Ducts and Plenums, Exposed in the Space Served	Uninsulated	NA
Supply and Return Ducts and Plenums, Exposed Other Than in the Space Served	Fiberglass Rigid Board	6
Outdoor Air Intake Ducts, Indoors	Fiberglass Rigid Board	6
Ducts Located Outdoors	Fiberglass Rigid Board	8
Unused Portions of Louvers	Louver Blank Off Panels	As Specified
Ductwork Upstream and Downstream of Air Handling Units and Supply and Return Fans, Located Indoors	Internal Acoustic Duct Lining	Note 1, 2

Ductwork Upstream and Downstream of Air Handling Units and Supply and Return Fans, Located Outdoors	Internal Acoustic Duct Lining	Note 1, 2
General Exhaust Ducts Except as Noted	Uninsulated	NA

Notes:
1. Ductwork to be provided with 1-inch internal acoustic lining in addition to externally applied insulation in accordance with the table above.
2. Unless noted otherwise on drawings, duct liner shall be continuous, extending from air handling unit/fan sections out for a linear distance of 20'.

B. Interior Concealed Range Hood and Elevated Temperature Exhaust Ducts

Ductwork System	Type	Thickness (In)
Kitchen Hood Exhaust Ducts	Fire Rated Blanket	Two layers 1-1/2” Each

END OF SECTION 230719

PART 1 - GENERAL

1.01 COMMISSIONING CONTRACT

A. The Owner will employ an independent Commissioning Authority (CA). The mechanical contractor shall support all commissioning efforts as defined here-in and as required by the CA, in reference specifications or as otherwise required under standard care of the type of project and it's delivery.

1.02 DESCRIPTION

A. General provisions and other mechanical systems are specified in other Sections of Division 23.

B. Commissioning is an ongoing process and shall be performed throughout construction. Commissioning requires the participation of Division 23 to ensure that all systems are operating in a manner consistent with the Contract Documents. Division 23 shall be familiar with the commissioning plan issued by the Commissioning Authority (CA) as it applies to the work of Division 23 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

C. Commissioning shall conclude with the completion of all required deferred testing, training and system documentation as specified and required to ensure the proper operation of the mechanical equipment and systems provided by this Division.

D. This Section covers mechanical systems commissioning, as required to demonstrate that the equipment and systems of Division 23 are ready for safe and satisfactory operation, as defined by project documents. Commissioning shall include, but shall not be limited to, identification of piping and equipment, cleaning, lubrication, start-up, check-out, and testing, adjusting, and balancing of systems, preparation of equipment and systems documentation and of maintenance and operation manuals, Owner training, and preparation of record drawings.

1.03 QUALITY ASSURANCE

A. The mechanical contractor shall identify a mechanical commissioning supervisor. The mechanical commissioning supervisor should have a minimum of ten years experience in mechanical contracting. The mechanical commissioning supervisor shall become familiar with the design intent and the requirements of the commissioning process as defined in this Section. The mechanical commissioning supervisor shall attend all commissioning meetings and coordinate the commissioning schedule as outlined by the CA. The mechanical commissioning supervisor shall assist the CA in coordinating and executing the required commissioning activities.

1.04 MECHANICAL CONTRACTOR RESPONSIBILITIES

A. Include and itemize the cost of commissioning in the contract price with an estimated breakdown of hours for meeting and functional testing requirements.

B. The mechanical commissioning supervisor shall be responsible for scheduling, supervising, and coordinating the startup, testing and commissioning activities as specified herein with the CA. Specific requirements of the mechanical contractor and associated subcontractors are identified in this Section and in other Sections of this Division.

C. The CA shall conduct independent verification of installation, pre-functional, start-up and functional testing as required here-in.

D. Mechanical commissioning shall take place in three phases. Commissioning requirements for each phase are as follows:
   1. Construction Phase
      a. The Contractor shall attend a Commissioning Scoping meeting and additional commissioning meetings as required throughout the commissioning process. These commissioning meetings will be monthly during early construction and may increase in frequency to weekly during the start-up, pre-functional and functional testing phases. The Contractor shall assure that all subcontractors who have commissioning responsibilities attend the Commissioning Scoping meeting and other commissioning meetings, as appropriate, during the construction process.
      b. The Contractor shall report, in writing, to the CA at least as often as commissioning meetings are scheduled concerning the status of his activities as they affect the commissioning process, the status of each discrepancy identified, the pre-functional and functional testing process, explanations of any disagreements with the identified deficiencies, and proposed resolution and schedule.
      c. The Contractor shall provide the CA with normal cut sheets and shop drawing submittals of equipment that is to be commissioned.
      d. The Contractor shall provide documentation to the CA for development of pre-functional and functional performance testing procedures, prior to normal O&M manual submittals. This documentation shall include detailed manufacturer installation, start-up, operating, troubleshooting and maintenance procedures; full details of any owner-contracted tests; fan and pump curves; full factory testing reports, if any; and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA. The CA may request further documentation necessary for the development of functional performance testing and the commissioning process. This data request may be made prior to normal submittals.
      e. The Contractor shall develop and submit to CA, for review prior to equipment or system startup, a complete startup and initial checkout plan using manufacturer's start-up procedures.
      f. The Contractor shall review and complete the CA's pre-functional check-sheets and sign-off on the appropriate areas when the Contractor and sub-contractors are complete. The pre-functional test sheets will be developed by the CA. The CA may conduct their own pre-functional testing check in parallel with the Contractors or verify the contractors completed pre-functional forms after submission.
      g. The Contractor shall provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review.
      h. The Contractor shall assist in clarifying the proposed operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
      i. The CA shall prepare the specific functional test procedures as specified herein. The Contractors shall review the CA's proposed functional performance test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
      j. Contractor shall prepare a preliminary schedule for Division 23 commissioning activities, to include pipe and duct system testing, flushing and cleaning, equipment start-up, and TAB start and completion, for use by the CA and shall update the schedule as appropriate. CA will assist in providing expected time durations for Cx activities.
      k. The Contractor shall update the commissioning activities and notify any delays in the progress meetings. Contractor shall notify the CA during the commissioning meetings when commissioning activities not yet performed or not yet scheduled will delay construction. Mechanical equipment start-up shall not be initiated until the complete

sign-off of the pre-functional check-sheets as developed by the CA as specified in other Sections of Division 23.

l. The Contractor shall provide startup testing for all HVAC equipment, including the building automation control system and shall execute the mechanical-related portions of the pre-functional checklists for all commissioned equipment during the startup and initial checkout process. The CA shall conduct an independent start-up once the Contractor is complete with their requirements.

m. The Contractor shall perform and clearly document all completed start-up and system operational checkout procedures, providing a copy to the CA.

n. The Contractor shall correct current A/E punch list and CA deficiency items before functional performance testing can begin. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air or water related systems.

o. The CA shall generate the functional testing procedure and record to the mechanical contractor. The mechanical contractor shall review and provide support to the functional testing process. Contractor shall operate boilers, pumps, etc., and systems in accordance with the CA requirements, open and close disconnects and switch normal and emergency power requirements as directed by the CA and the functional testing procedures.

p. The Contractor shall report in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each outstanding discrepancy identified during commissioning, pre-functional and functional performance testing. Report shall include description of the identified discrepancy, explanations of any disagreements, and proposals and schedule for correction of the discrepancy.

    1) Acceptance Phase. The Contractor shall assist and cooperate with the CA in the commissioning process by:

        (a) Putting all HVAC equipment and systems into operation and continuing the operation during each working day of the test and balance and commissioning effort, as required.

        (b) For a given area, have all required pre-functional checklists, calibrations, startup and selected functional tests of the mechanical system and associated controls completed and approved by the CA prior to beginning the test and balance process.

        (c) Provide a qualified technician to operate the controls as required to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.

        (d) Provide a TAB representative to assist the CA on conducting a random 10% check of the air and water distribution requirements.

        (e) Including cost of sheaves and belts that may be required to obtain required equipment performance, as measured by the test and balance effort.

        (f) Providing test holes in ducts and plenums where directed by TAB to allow air measurements and air balancing. Providing an approved plug.

        (g) Providing temperature and pressure taps according to the Construction Documents for TAB and commissioning testing.

        (h) Installing a P/T plug at each water sensor that is an input point to the Control System.

        (i) Providing skilled technicians to execute starting and operation of equipment.

        (j) The CA will conduct functional performance testing. The Contractor may be required to have a skilled technician present during functional testing, although it is suggested that one be available to make adjustments or assist in problem-solving.

        (k) The CA will require full and part load performance verifications as well as seasonal and simulated testing requirements. The Contractor shall be prepared to operate different components of various systems (example, DX and hot water systems to generate loading strategies) during the functional testing.

(l) Correct deficiencies (differences between specified and observed performance) as interpreted by the CA and A/E.
(m) Prepare O&M manuals according to the Contractor Documents, including clarifying and updating the original sequence of operation to as-built conditions.
(n) Maintain on site redline as built drawings and produce final “As-built” drawings for all project drawings and contractor-generated coordination drawings. List and clearly identify on the as-built drawings the locations of all airflow stations and sensor installations that are not equipment mounted.
(o) Provide specified training of the Owner’s operating personnel in accordance with the CA’s overview and outline.
(p) Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
(q) Provide updated diagrammatical logic for all TAB adjustments to the system.

2) Warranty Period. During the warranty period, the Contractor shall:
(a) Be available during seasonal or deferred functional performance testing conducted by the CA, according to the specifications.
(b) Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

1.05 TAB CONTRACTOR RESPONSIBILITIES

A. Six weeks prior to the starting of the T&B, submit to the CA, the qualifications of the site technician(s) for the project, including three (3) names of contractors and facility managers of recent projects on which the personnel were in charge. The Owner and CA will approve the site technician for this job.

B. Three months prior to the start of the TAB, submit a TAB plan and approach for each system. The plan shall be reviewed by the TAB and the CA for review and approval. The submitted plan shall include:
1. Certification that the TAB contractor has reviewed the construction documents and the systems with the design engineers and Contractors to sufficiently understand the design intent for each system.
2. An explanation of the intended use of the building control system.
3. All field check-out sheets and logs to be used that lists each piece of equipment to be tested adjusted and balanced with the data cells to be gathered for each.
4. Final test report forms to be used during this process:
a. Detailed step by step procedures for TAB work for each system and issue: terminal flow calibration; diffuser proportioning; branch and submain proportioning; total flow calculations; and rechecking diversity issues.
b. List all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of each of the test procedures, parameters and formulas to be used.
c. Details of how total flow will be determined (Air: sum of terminal flows via BMS calibrated readings or via hood, pitot tube or flow stations). Details of how total water flow will be determined (Water: pump curves, circuit setters, flow station, ultrasonic, etc.).
d. The identification and types of measurement instruments to be used and their most recent calibration date.
e. Specific procedures that will ensure that both air and watersides will be operating at there lowest possible pressure at the point where the system will operate.
f. Confirmation that the TAB contractor understands the outside air ventilation criteria under all conditions and how this will be measured during normal, economizer and unoccupied conditions.

g. Details of how building static, room static and exhaust fan capacity will be checked.
h. Proposed selection points for traverse measurement locations on the as-built documents. Review the placement of the HVAC measurement devices for proper straight runs and accuracy.
i. Submit a plan for testing and checking the fume hood system exhaust requirements.
j. Plan for formal progress reports including scope and frequency.
k. Plan for formal deficiency reports including scope and frequency.
    1) TAB contractor shall attend commissioning meetings as directed by the CA and the general contractor.
    2) TAB contractor shall communicate in writing to the controls contractor and the CA all setpoint and parameter changes made or problems and discrepancies identified during the TAB process that would affect the control loop system set-up and operation.
    3) Submit written report of discrepancies, deficit or uncompleted work by others, contract interpretation requests and list of completed tests to the CA at least once per week.
    4) After the TAB plan is accepted and two-weeks prior to TAB work, the contractor shall conduct a pre-balancing conference. Prior to the pre-balancing conference, the TAB contractor shall inspect the system readiness for testing and balancing. The TAB contractor shall prepare a list of deficiencies and uncompleted work that will affect the TAB process. This list shall be submitted to the CA and the general contractor.
    5) The TAB contractor shall review the projected schedule and provide, in writing, to the CA and CM any delays in the schedule and what items will require completion prior to the TAB work.
    6) The CA agent shall conduct independent verification of 10% of air and water end-devices for acceptance after the TAB contractor states in writing that they are complete with Testing & Balancing. The TAB contractor shall provide a mechanic to assist the CA in this verification and shall include this in the scope and price of the Work.
    7) The TAB agent shall submit the TAB report to the CA for his review and comment. All data contained shall be re-verified in the field by the CA. A minimum of ten percent of the airflow readings shall be verified by the CA using his own equipment. All selection points shall be random. Total airflow shall be verified on all mains in the supply and the exhaust ducts.

1.06 CONTROL CONTRACTOR RESPONSIBILITIES

A. Include and itemize the cost of commissioning in the contract price with an estimated breakdown of hours for meeting and functional testing requirements.

B. The controls commissioning supervisor shall be responsible for scheduling, supervising, and coordinating the startup, testing and commissioning activities as specified herein with the CA. Specific requirements of the controls contractor and associated subcontractors are identified in this Section and in other Sections of this Division.

C. The CA shall conduct independent verification of installation, pre-functional, start-up and functional testing as required here-in.

D. Controls commissioning shall take place in three phases. Commissioning requirements for each phase are as follows:
    1. Construction Phase
        a. Contractor shall attend a Commissioning Scope meeting and additional commissioning meetings as required throughout the commissioning process. These commissioning meetings will be monthly during early construction and increase in frequency to weekly during the start-up, pre-functional and functional testing phases.

Contractor shall assure that all subcontractors who have commissioning responsibilities attend the Commissioning Scope meeting and other commissioning meetings, as appropriate, during the construction process.

b. Contractor shall report, in writing, to the CA at least as often as commissioning meetings are scheduled concerning the status of his activities as they affect the commissioning process, the status of each discrepancy identified, the pre-functional and functional testing process, explanations of any disagreements with the identified deficiencies, and proposed resolution and schedule.
c. Contractor shall provide the CA with normal cut sheets and shop drawing submittals of equipment that is to be commissioned.
d. Contractor shall provide documentation to the CA for development of pre-functional and functional performance testing procedures, prior to normal O&M manual submittals. This documentation shall include detailed manufacturer installation, start-up, operating, troubleshooting and maintenance procedures; full details of any owner-contracted tests; points listing; full factory testing reports, if any; and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the CA. The CA may request further documentation necessary for the development of functional performance testing and the commissioning process. This data request may be made prior to normal submittals.
e. The Contractor shall develop and submit to CA, for review prior to equipment or system startup, a complete startup and initial checkout plan using manufacturer's start-up procedures.
f. The Contractor shall review and complete the CA's pre-functional check-sheets and sign-off on the appropriate areas when the Contractor and sub-contractors are complete. The pre-functional test sheets will be developed by the CA. The CA may conduct their own pre-functional testing check in parallel with the Contractors or verify the contractors completed pre-functional forms after submission.
g. Contractor shall provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review.
h. Contractor shall assist in clarifying the proposed operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
i. CA shall prepare for the specific functional test procedures as specified herein. The Contractors shall review the CA's proposed functional performance test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
j. Controls contractor shall prepare a preliminary schedule for their commissioning activities, to include wiring, instrument installation, calibration, point-to-point verification, sequence of operation testing and emergency operating procedural testing for use by the CA and shall update the schedule as appropriate. The Contractor shall update the commissioning activities and notify any delays in the progress meetings. Contractor shall notify the CA during the commissioning meetings when commissioning activities not yet performed or not yet scheduled will delay construction.
k. Controls instrument and equipment start-up shall not be initiated until the complete sign-off of the pre-functional check-sheets as developed by the CA as specified in other Sections of Division 23.
l. Contractor shall provide startup testing for all HVAC equipment, including the building automation control system and shall execute the mechanical/controls-related portions of the pre-functional checklists for all commissioned equipment during the startup and initial checkout process. The CA shall conduct an independent start-up once the Contractor is complete with their requirements.

m. Contractor shall perform and clearly document all completed startup and system operational checkout procedures, providing a copy to the CA.
n. Contractor shall correct current A/E punch list and CA deficiency items before functional performance testing can begin. Point-to-point verification shall be completed with discrepancies and problems remedied before functional testing of the respective controls related systems.
o. The CA shall generate the functional testing procedure and record to the controls contractor. The controls contractor shall review and provide support to the functional testing process. Contractor shall aid in operating boilers, pumps, etc., and systems in accordance with the CA requirements, turn on and off normal and emergency power requirements as directed by the CA and the functional testing procedures.
p. Contractor shall report, in writing, to the CA at least as often as commissioning meetings are being scheduled concerning the status of each outstanding discrepancy identified during commissioning, pre-functional and functional performance testing. Report shall include description of the identified discrepancy, explanations of any disagreements, and proposals and schedule for correction of the discrepancy.
    1) Acceptance Phase. Contractor shall assist and cooperate with the CA in the commissioning process by:
        (a) Putting all HVAC equipment and systems into operation and continuing the operation during each working day of the test and balance and commissioning effort, as required.
        (b) For a given area, have all required, pre-functional checklists, calibrations, startup and selected functional tests of the mechanical system and associated controls completed and approved by the CA prior to beginning the test and balance process.
        (c) Provide a qualified technician to operate the controls as required to assist the TAB contractor in performing TAB, or provide sufficient training for TAB to operate the system without assistance.
        (d) Provide a controls representative to assist the CA on conducting a random 10% check of the air and water distribution requirements.
        (e) Providing skilled technicians to execute starting and operation of equipment.
        (f) The CA will conduct functional performance testing. The Contractor may be required to have a skilled technician present during functional testing, although it is suggested that one be available to make adjustments or assist in problem-solving.
        (g) The CA will require full and part load performance verifications as well as seasonal and simulated testing requirements. The Contractor shall be prepared to operate different components of various systems (example, chilled water and hot water systems to generate loading strategies) during the functional testing.
        (h) Correct deficiencies (differences between specified and observed performance) as interpreted by the CA and A/E.
        (i) Prepare O&M manuals according to the Contractor Documents, including clarifying and updating the original sequence of operation to as-built conditions.
        (j) Maintain on site redline as built drawings and produce final “As-built” drawings for all project drawings and contractor-generated coordination drawings. List and clearly identify on the as-built drawings the locations of all airflow stations and sensor installations that are not equipment mounted.
        (k) Provide specified training of the Owner’s operating personnel in accordance with the CA’s overview and outline.
        (l) Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
        (m) Provide a detailed marked up drawings of all the instruments and their installed location (P&ID) for instruments and components.
    2) Warranty Period. During the warranty period, the Contractor shall:

(a) Be available during seasonal or deferred functional performance testing conducted by the CA, according to the specifications.
(b) Correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

PART 2 - PRODUCTS

2.01 SYSTEMS TO BE COMMISSIONED

A. The following are systems to be commissioned:
   1. VRF System
   2. DOAS Units
   3. ATC System (test functionality as it has been modified by systems above)

2.02 2.2. TEST EQUIPMENT

A. All standard testing equipment required to the mechanical portion startup, initial checkout shall be provided by the Contractor responsible for the equipment or system being tested. This includes TAB and controls verification.

B. The CA shall perform their own system verification and performance check-out. The CA shall provide their own calibrated equipment as required for this testing.

C. All testing equipment associated with functional performance verification and point-to-point required by the CA shall be the responsibility of the CA. All testing equipment associated with the control's contractor point-to-point verification shall be the responsibility of the control's contractor.

D. Special equipment, tools and instruments (only available from vendor or specific to a piece of equipment) required for the functional testing of that equipment, according to the requirements of the contract documents and the functional test procedures shall be provided to the CA by the installing contractor and shall become the property of the Owner at project completion as indicated in the specification.

E. Proprietary test equipment and software required by any manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide test equipment, demonstrate its use and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon successful completion of the commissioning process as required in the specifications.

PART 3 - EXECUTION

3.01 SUBMITTALS

A. Division 23 shall provide submittal documentation relative to commissioning as required in this Section Part 1.

3.02 3.2 STARTUP PLAN AND PREFUNCTIONAL TESTING

A. The mechanical contractor and associated subcontractors shall be responsible for the installation of complete systems and sub-systems, fully functional, meeting the design objectives of the Contract Documents. Contractor shall follow the approved start-up, initial checkout, and pre-functional testing procedures. The commissioning procedures and functional testing do not relieve or lessen this responsibility or shift that responsibility to the CA or Owner.

B. Pre-functional testing as directed and performed by the contractor shall be required for each piece of equipment to ensure that the equipment and systems are properly installed and ready for operation, so that functional performance testing to may proceed without delays. Sampling strategies shall not be used for pre-functional testing. The pre-functional testing for all equipment and subsystems of a given system shall be successfully completed and documented prior to functional performance testing of the system. The mechanical contractor and sub-contractors shall sign off on the CA's pre-functional test sheets that they are complete and the system is ready. The CA will verify and conduct their own independent verification and start-up in parallel to the Contractor's verification. Any deficiencies identified during this process shall be noted and reviewed by the Contractors. Start-up and functional testing shall not proceed until all the deficiencies are corrected and verified by the CA.

C. The following procedures shall apply to all equipment and systems to be commissioned.
   1. Start-up and Initial Checkout Plan. The contractor shall develop the detailed start-up and pre-functional testing plans for all equipment to be reviewed by the CA. The primary role of the CA in this process shall be to review the installation for construction completeness and ensure that all components have been installed as per the design documents. Only when pre-functional testing is complete and signed off by all Contractors, shall the Contractor start-up the equipment. Equipment and systems to be commissioned are identified in this Section Part 2.
   2. The start-up and initial checkout plan shall consist of the following as a minimum:
      a. The manufacturer's standard written start-up and checkout procedures copied from the installation manuals and manufacturer's normally used field checkout sheets. The plan shall include checklists and procedures with specific boxes or lines for recording and documenting the checking and inspections of each procedure and a summary statement with a signature block at the end of the plan.
      b. First-run checklist for equipment, to include:
         1) Equipment properly set.
         2) Alignment of shafts and couplings.
         3) Adjustment of vibration isolators.
         4) Piping and equipment properly connected.
         5) Completion of initial lubrication procedures.
         6) Clean filters in place, as appropriate.
         7) Wiring properly connected.
         8) Electrical overload relays appropriate for load.
         9) Electrical accessories properly installed and adjusted.
         10) Controls, safeties, and time switches properly calibrated and set-up.
         11) Verification of direction of motor rotation after final electrical connections by jogging motor.
         12) Measurements of ampere draw of electric motors and comparison with nameplate rating and with overload heater ratings.
         13) The Contractor shall submit the start-up reports to the CA for review.

D. The CA shall review and approve the procedures and the format for documenting them, noting any procedures that need to be added.

E. Two weeks prior or startup, the Contractor shall schedule start-up and checkout with the Owner and CA. The execution of the start-up and checkout shall be directed and performed by the Contractor, in accordance with manufacturer's published procedures and with the approved procedures. The CA may be present for the Contractor's required startup and checkout of all systems and equipment to be commissioned.

F. Sensor Calibration. Calibration of all sensors shall be included as part of the pre-functional testing and listed on the appropriate test checklists and reports, according to the specified procedures and accuracies for the devices and systems being tested.

G. All contractor responsible start-up, checkout forms shall be completed and submitted to the CA for review.

3.03 FUNCTIONAL PERFORMANCE TESTS

A. Functional Performance Verification (FPV) is the dynamic testing of systems (rather than just individual components) under full, part and seasonal requirements. Systems are tested under various loads and control sequences, such as low cooling and heating loads, component failures, unoccupied modes, fire alarm, etc. The systems are run through all the control sequences of operation and components are verified to be responding as the design intent and documents. FPV shall include; testing all sequences of operations, verification of system capacity, generating simulated signals to simulate sensor values, conducting simulated conditions to tests all loads and verify system performance during all conditions of operation and verifying design intent. In addition, each system shall be tested through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part and full load). Proper responses such as power failures, freeze conditions, low-oil pressures, equipment failures, etc. shall also be tested. The CA develops the functional test sheets and procedures in sequential written form, coordinates the testing, conducts the testing and documents the testing. Each contractor is required is supply personnel to assist during the functional performance testing where applicable.

B. No system, equipment or component thereof shall be tested until the Contractor and the CM has certified, in writing, that the system, equipment and / or components are complete, have been tested, adjusted and balanced and are ready for validating and performance testing. FPV is scheduled by the CA after the pre-functional testing requirements are complete and signed-off by the CM and the CA. FPV will not be conducted until a written notice of completion by the CM confirming that the system is ready for FPV. The air balancing and water balancing must be complete and the controls must be debugged prior to the performance verification.

C. Functional testing shall be conducted by the CA. Functional testing may not proceed until the systems have been properly installed, started-up and all deficiencies have been corrected.

D. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CA and CM. Beginning system testing before full completion shall not relieve the Contractor from fully completing the system, including all pre-functional checklists.

E. The Contractor shall provide personnel to operate the systems while functional performance testing is commencing. This shall include but not be limited to; starting and stopping of systems, opening and closing valves to create false loads on the system (with the capabilities of the existing system) and allowing the CA to manipulate the building automation systems to modulate the system requirements.

F. The Contractor shall review the commissioning functional performance testing procedure supplied by the CA. After functional testing commences, the Contractor and the CA shall sign the functional test record and provide the owner and the CM a copy to review. All deficiencies either corrected in the field or outstanding shall be documented on the functional test forms for review by all parties.

G. All functional testing must be completed and approved by the CA and the owner before the project will be considered substantially complete.

3.04 DEFERRED TESTING

A. Deferred Testing. The Contractor shall be available to assist in seasonal testing (Summer, Winter and Intermediate), tests delayed until weather or other conditions until building construction is completed, required building occupancy or loading, or other conditions are suitable for the demonstration of equipment or system's performance, as specified. These deferred tests shall be conducted in the same manner as the seasonal tests as soon as possible. Deferred testing shall be executed, documented and deficiencies corrected as specified herein for functional performance testing. Any adjustments or corrections to the O&M manuals and "As built" documents required by the results of the testing shall be made before the seasonal testing process is considered complete.

3.05 TESTING DOCUMENTATION, NON-CONFORMANCE AND APPROVALS

A. The CA shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully. The testing form and any outstanding deficiencies shall be provided to the CM/Owner within two days of test completion. The CA shall review the Contractor's startup testing reports and shall submit either a non-compliance report or an approval form to the Contractor. The CA shall work with the Contractor and others as necessary, to correct and retest deficiencies or uncompleted items. The Contractor shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report with a Statement of Correction on the original non-compliance report. When all requirements are satisfactorily completed, the CA shall recommend approval of the startup and pre-functional testing of each system and schedule the functional testing of the equipment or system.

B. As functional performance testing progresses and a deficiency is identified, the CA shall discuss the issue with the executing contractor and the commissioning team.
   1. When there is no dispute of the deficiency and the Contractor accepts responsibility for correcting it, the CA shall document the deficiency and the Contractor's response and intentions and the testing shall proceed, if possible. Corrections of minor deficiencies identified may be made by the Contractor during the functional performance testing, at the discretion of the CA. Every effort shall be made or expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the commissioning effort.
   2. When the identified deficiency is corrected, the Contractor shall sign the statement of correction at the bottom of the non-compliance form, certifying that the equipment is ready to be retested, and return the form to the CA. The CA shall schedule the retest of the equipment or system involved.
   3. If there is a dispute about an identified deficiency, the CA shall document the deficiency and the Contractor's response, and provide a copy to the Contractor. Every attempt shall be made to resolve the dispute at the lowest management level possible. When the dispute resolution has been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and returns the form to the CA. The CA shall schedule the retest of the equipment or system involved. Final interpretive authority shall be the A/E. Final acceptance authority shall be the Owner.

C. During the functional performance testing of multiple units of similar equipment, the CA will test all of the installed equipment and components identified. If, under such a testing procedure, three or more identical pieces of equipment (size along does not constitute difference) fail to perform to the requirements of the Contract Documents (mechanically or substantively) due to manufacturing or installation defects not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CA. In such a case, the Contractor shall provide the CA with the following:

1. Within one week of notification from the CA, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the CA within two weeks of the original notice.
2. Within two weeks of the original notification, the Contractor shall provide the CA and the A/E a signed and dated, written explanation of the problem, cause of failures, etc., and proposed solution, including full equipment submittals for corrective or replacement equipment, if appropriate. The proposed solution shall not be for less than the specification requirements of the original installation.
3. When approved, two examples of the proposed solution shall be installed by the Contractor and the CA shall schedule and conduct functional testing of the proposed solution. Upon completion of the functional testing of the proposed solution, the CA shall recommend the acceptance or disapproval of the proposed solution to the Owner.
4. Upon acceptance of the proposed solution by the Owner, the Contractor shall replace or repair all identical items, at their expenses and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week of approval of the proposed solution.
5. Cost of Retesting
    a. The cost for CA and/or Owner personnel to conduct the retesting of a functional performance testing requirements necessitated because a specific pre-functional or start-up test item, reported to have been successfully completed, but found to be incomplete or faulty, shall be the responsibility of the Contractor.
    b. For a deficiency identified during the functional testing, not related to any pre-functional checklist or start-up fault, the CA and Owner shall direct the retesting of the equipment once at "no charge" for their time. However, all costs for any subsequent retesting shall be the responsibility of the Contractor.
    c. Items left incomplete, which later cause deficiencies or delays during functional testing may result in back-charges to the responsible party.

3.06 OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Division 23 shall compile and prepare documentation for all equipment and systems covered in Division 23 and deliver this documentation to the CM for inclusion in the O&M manuals, according to this section and and other applicable section, prior to the training of owner personnel.

C. The CA shall receive a copy of the O&M manuals for review.

D. Operation and maintenance documentation, in hardback 3-ring loose-leaf binders except full size drawings and diskettes, shall cover all mechanical systems. Documentation shall include the following: operations and maintenance documentation directory; emergency information; operating manual; emergency information; maintenance manual; test reports; and construction documents.

E. The operation and maintenance documentation package shall be submitted as one comprehensive package to the Owner and CA before systems start-up and commissioning, and shall be updated, revised and completed during, and at completion of, commissioning.

3.07 TRAINING OF OWNER PERSONNEL

A. The mechanical commissioning supervisor shall be responsible for training coordination and scheduling of required training and for ensuring that all required training is completed. The CA shall oversee the content and adequacy of the training of Owner personnel.

B. Prepare and submit a syllabus describing an overview of the program, describing how the program will be conducted, when and where meetings are to be held, names and company affiliations of lecturers, description of contents and outline for each lecture, and recommended reference material and outside reading. Obtain direction from the Owner on which operating personnel shall be instructed in each system. Proposed training schedules, materials, and lesson plans shall be submitted to the CA for review of the content and adequacy of the training of Owner personnel for commissioned equipment or systems.

C. Mechanical Contractor. The mechanical contractor shall have the following training responsibilities:
   1. Provide the CA with training plan one week before the planned training.
   2. Provide designated Owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment.
   3. Training shall normally start with classroom sessions followed by hands-on training on each piece of equipment.
   4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary and the demonstration repeated.
   5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. This person may be the start-up technician for the piece of equipment, the installing contractor or manufacturer's representative. Practical building operating expertise, as well as in-depth knowledge of all modes of operation of the specific piece of equipment, is required. More than one party may be required to execute the training.
   6. The controls contractor shall attend sessions other than the controls training, for each type of equipment controlled by the BAS, to discuss the interaction of the BAS as it relates to the equipment being discussed.
   7. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

3.08 WRITTEN WORK PRODUCTS

A. Written work products of Contractors shall consist of the start-up and initial checkout plan and the filled out start-up, initial checkout and pre-functional checklists.

END OF SECTION 230800

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work specified as part of this Section consists of the integration of equipment controls supplied as part of manufactured items, materials and equipment required by the Drawings and under Divisions 23 and 26 to achieve operational and coordinated Sequences of Operation as Specified. Work shall include management of the system start up and operational check out, coordination of functions of controllers supplied as part of equipment packages, sizing of control valves and damper operators for dampers, interconnection of systems, provision and installation of all accessory devices required for complete system operation including dampers, control valves and actuators not provided as part of equipment, coordination of start up and testing and demonstration of the operation of Sequences of Operation to the Owner and his representatives.

1.02 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are a part of these Specifications and shall be used in conjunction with this Section as a part of the Contract Documents. Consult them for further instructions pertaining to this work. The Contractor is bound by the provisions of Division 00 and Division 01.

B. The following Sections constitute related work:
   1. Section 230010 - General Mechanical Requirements
   2. Equipment and Systems specified under Division 23
   3. Division 26

1.03 QUALITY ASSURANCE

A. System Installer Qualifications
   1. The Integrator shall have a minimum of five years experience in the integration of systems of a similar nature to those of this Project.
   2. The Integrator shall have an office within 50 miles of the project site and provide 24-hour response in the event of a customer call.

B. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.
   1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
   2. National Electrical Code - NFPA 70.

C. All products used in this installation shall be new, currently under manufacture, and shall have been applied in similar installations for a minimum of 2 years. This installation shall not be used as a test site for any new products unless explicitly approved by the Owner's representative in writing prior to bid date. Spare parts shall be available for at least 5 years after completion of this Contract.

1.04 SUBMITTALS

A. Submit at the time of bid the name and qualifications of the firm that will be responsible for the Integration function along with the qualifications of the specific personnel proposed. The Owner and Architect/Engineer may choose to interview the personnel proposed for the project.

B. Contractor shall provide shop drawings and manufacturer’s standard specification data sheets on all materials and hardware to be provided. No work may begin on any segment of this project until the Architect/Engineer and Owner have reviewed submittals for conformity with the

Drawings and Specifications. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats.

C. Submit a written sequence of operation for each system indicating which functions are to be controlled by controls provided as part of manufactured equipment and which functions will be under control of devices provided as part of this Section.

D. Submit interconnecting wiring diagrams for all systems. These diagrams may rely on diagrams for controls of manufactured equipment provided that the interface points are clearly identified and copies of the manufactured item's control diagrams are submitted for information as part of the submittal package.

E. Submit any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in documenting the system to be installed.

F. Submit the following within 30 days of contract award:
   1. A work plan and schedule for the start up and check out of all systems including time requirements and resources required from all Sub-Contractors involved.
   2. A complete list of equipment to be used indicating quantity, manufacturer and model number.
   3. A schedule of all control valves including the valve size, model number (including pattern and connections), flow, CV, pressure rating, and location.
   4. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
   5. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover.
   6. The submittals required under this Section shall be considered as For Information Only. Review by the Architect/Engineer shall not relieve the Contractor from the responsibility of providing fully operational systems.

1.05 WARRANTY

A. Warrant all work as follows:
   1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
   2. At the end of the final start-up/testing, if equipment and systems are operating in a manner satisfactory to the Owner and Architect/Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this Specification. The date of Owner's acceptance shall be the start of warranty.

PART 2 - PRODUCTS

2.01 STANDARD OF QUALITY AND PERFORMANCE

A. Products specified are not intended to form a complete scope of supply. They are intended to set a level of quality for items that the Contractor may need to supply to implement a complete Sequence of Operation. Products of a comparable quality and performance may be submitted for approval by the Architect/Engineer.

2.02 MOTORIZED DAMPERS

A. Dampers shall be modulating double-acting opposed blade or parallel blade dampers as required, designed and tested in accordance with AMCA 500, and meeting current energy code. Obtain and verify the location, size and pressure rating of each damper prior to fabrication and delivery. Verify the layout of equipment and ductwork before dampers are fabricated. Pressure drop shall not exceed 0.03 inches water gauge static pressure at 1000 fpm in the fully-open position, and shall be rated for at least 2000 fpm average velocity. Damper shut-off pressure rating shall exceed the fan maximum total head-pressure.

B. Dampers shall be constructed of extruded aluminum or at least No. 16 gauge galvanized steel, with each blade being not more than 8 inches; wide damper frame channel shall be at least 5 inches deep. Each blade end shall have a 3/8 inch stainless steel or plated steel shaft rotating in self-lubricating bearings mounted in a damper channel frame. Blades mounted vertically shall be supported by thrust bearings. Control shaft shall be at least ½ inch diameter.

C. Flat-steel damper blades shall be made rigid by folding the edges. Blades shall have interlocking edges and shall be provided with EPDM or neoprene compressible seals at point of contact. Foam seals are not acceptable. Provide compression-type stainless steel jamb seals continuously along blade edges.

D. Each damper shall be assembled in the manufacturer's shop as a complete unit. Dampers, when closed, shall be guaranteed by the manufacturer not to leak in excess of 20 cfm per square foot at 4 inches w.g. static pressure. Provide dampers with operators having sufficient power to limit leakage to the rate specified.

E. Damper seals shall be suitable for an operating range of minus 20 degrees F (or 20 degrees F below the heating outside design temperature, whichever is lower) at the lower end to 200 degrees F at the upper end.

F. A complete damper assembly shall have blades no longer than 48 inches and no higher than 48 inches. Where greater length or height is required, the assembly shall be made of a combination of sections. Dampers shall be sized for the required air velocity and pressure classification.

G. Approved Manufacturers: Greenheck (VDC-23), Arrow or approved equal.

2.03 ELECTRONIC DAMPER/VALVE ACTUATORS

A. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

B. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing.
   1. Damper actuators shall fail normally open or closed as described on the Drawings or as follows:
      a. Outdoor Air Intake - normally closed.
      b. Air Exhaust - normally closed.
      c. Other applications - as as required by the Sequence of Operation.

C. All rotary spring return actuators shall be capable of both clockwise and counter clockwise spring return operation.

D. Proportional actuators shall accept a 0-10 VDC or 0-20 ma control signal and provide a 2-10 VDC or 4-20 ma operating range.

E. All 24 VAC/DC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 W for DC applications. Actuators operating on 120 VAC or 230 VAC shall not required more than 11 VA.

F. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper 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.

G. Actuators shall be provided with a conduit fitting and a minimum 1 meter electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.

H. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation

I. Actuators shall be Underwriters Laboratories Standard 873 listed.

J. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque.

K. Provide a single damper actuator when dampers are less than 4 feet in width. Otherwise provide two damper actuators (one on each side of the ductwork).

2.04 CONTROL VALVES

A. Control valves shall be two-way or three-way type for two-position or modulating service as required.

B. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
   1. Water Valves:
      a. Two-way: 150% of total system (pump) head.
      b. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
   2. Steam Valves: 150% of operating (inlet) pressure.

C. Valve Failure Position:
   1. Valves shall fail normally open or closed as indicated on the Drawings or as follows:
      a. Heating coils in air handlers - normally open.
      b. Chilled water control valves - normally closed
      c. Other applications - as scheduled or as required by Sequence of Operation.
   2. Zone valves shall be sized to meet the control application and they shall maintain their last position in the event of a power failure.

D. Water Valves:
   1. Body and trim materials shall be as specified in “Pipe, Valve & Fittings” specification. Equal percentage ports for modulating service.
   2. Sizing Criteria:
      a. Three-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), [5] psi maximum.
      b. Contractor shall verify sizing criteria with manufacturer.

E. Steam Valves:
   1. Body and trim materials shall be as specified in “Pipe, Valve & Fittings” specification. Linear ports for modulating service.

2. Sizing Criteria:
   a. Two-position service: pressure drop 10% to 20% of inlet pressure (psig).
   b. Modulating service 15 psig or less: pressure drop 80% of inlet pressure (psig).
   c. Modulating service 16 psig to 50 psig: pressure drop as scheduled on plans.
   d. In all cases above the contractor shall verify sizing criteria with the valve manufacturer.

2.05 TEMPERATURE SENSORS

A. Temperature sensors shall be Resistance Temperature Device (RTD) or Thermistor.

B. Duct sensors shall be rigid or averaging as required. Averaging sensors shall be a minimum of 5 feet in length.

C. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.

D. Space sensors shall be equipped with set-point adjustment, override switch, display, and communication port.

E. Provide matched temperature sensors for differential temperature measurement. Differential accuracy shall be within 0.2 degrees F.

F. The space temperature, setpoint, and override confirmation shall be annunciated by a digital display for each zone sensor. The setpoint shall be selectable utilizing buttons.

2.06 HUMIDITY SENSORS

A. Room Humidity sensors shall have an accuracy of ±1% 25°C from 10% to 80% RH with One-point adjustment calibration. The operating temperature range shall be -10° to 150°F max.

B. Duct sensors shall have a sensing range of 20% to 80% with accuracy of ±1% R.H. Duct sensors shall be provided with a sampling chamber.

C. Outdoor air humidity sensors shall have a sensing range of 20% to 95% R.H. and shall be suitable for ambient conditions of -40 degrees F to 170 degrees F.

D. Humidity sensor's drift shall not exceed 1% of full scale per year.

2.07 STATIC PRESSURE SENSORS

A. Sensor shall have linear output signal. Zero and span shall be field-adjustable.

B. Sensor sensing elements shall withstand continuous operating conditions plus or minus 50% greater than calibrated span without damage.

C. Water pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Sensor shall be complete with 4-20 ma output, required mounting brackets, and block and bleed valves. Mount in location accessible for service.

D. Water differential pressure sensor shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (DP) and maximum static pressure shall be 3,000 psi. Transmitter shall be complete with 4-20 ma output, required mounting brackets, and five-valve manifold. Mount in a location accessible for service.

2.08 LOW LIMIT THERMOSTATS

A. Safety low limit thermostats shall be vapor pressure type with an element 20 ft minimum length. Element shall respond to the lowest temperature sensed by any one foot section.

2.09 FLOW SWITCHES

A. Flow-proving switches shall be either paddle or differential pressure type, as shown on the Drawings or as specified.

B. Paddle type switches (water service only) shall be UL listed, SPDT snap-acting with pilot duty rating (125 VA minimum). Adjustable sensitivity with NEMA 1 Type enclosure unless otherwise specified:

C. Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 Type enclosure, with scale range and differential suitable for intended application, or as specified.

D. Current sensing relays may be used for flow sensing or terminal devices.

2.10 RELAYS

A. Control relays shall be UL listed plug-in type with dust cover. Contact rating, configuration, and coil voltage suitable for application.

B. Time delay relays shall be UL listed solid-state plug-in type with adjustable time delay. Delay shall be adjustable plus or minus 200% (minimum) from set-point shown on plans. Contact rating, configuration, and coil voltage suitable for application. Provide NEMA 1 Type enclosure when not installed in local control panel.

2.11 TRANSFORMERS AND POWER SUPPLIES

A. Control transformers shall be UL listed, Class 2 current-limiting type, or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.

B. Unit output shall match the required output current and voltage requirements. Current output shall allow for a 50% safety factor. Output ripple shall be 3.0 mV maximum Peak-to-Peak. Regulation shall be 0.10% line and load combined, with 50 microsecond response time for 50% load changes. Unit shall have built-in over-voltage protection.

C. Unit shall operate between 0 degrees C and 50 degrees C.

D. Unit shall be UL recognized.

2.12 CURRENT SWITCHES

A. Current-operated switches shall be self-powered, solid state with adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the control system.

2.13 LOCAL CONTROL PANELS

A. All indoor control cabinets shall be fully enclosed NEMA 1 or NEMA 4 rating as required. Provide cabinet with hinged door, key-lock latch, and removable sub-panels. A single key shall be common to all field panels and sub-panels.

B. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL listed for 600-volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

C. Provide on/off power switch with over-current protection and main air gauge for control power sources to each local panel.

2.14 AIR FLOW MEASURING STATIONS

A. Air flow measuring stations shall be multi-point, multi-axis flow ring or cross sensor. Single point or flow bar sensors are not acceptable. The airflow measurement station shall measure from 15 percent to 100 percent of unit nominal airflow. The air flow measuring station shall adjust for temperature variations and shall provide a 2 to 10 Vdc signal that corresponds to actual airflow for controlling and documenting airflow. The accuracy of the airflow measurement station shall be +- 5 percent.

B. Air flow measuring stations shall be provided by the air handler manufacturer or the VAV box manufacturer. See air handler or VAV box specification section for more details.

2.15 WALL MOUNTED CARBON DIOXIDE SENSORS

A. Carbon dioxide sensors shall be of the wall mounted type.

B. Sensors shall be of the auto-calibrated type designed to operate from 24VAC or 24VDC power.

C. Range: 0-2000 ppm CO2

D. Accuracy: ±30 ppm CO2 + 3% of reading

E. Annual Zero Drift: ±10 ppm

F. Response Time: < 3 minutes

G. Output Signals:
   1. 0-10 VDC
   2. 4-10 mA or 2-10 VDC

H. Resolution of Analog Outputs: 2 ppm CO2

I. Housing Material: Polycarbonate/ABS blend

J. The space temperature, setpoint, and override confirmation shall be annunciated by a digital display for each zone sensor. The setpoint shall be selectable utilizing buttons.

PART 3 - EXECUTION

3.01 GENERAL WORKMANSHIP

A. Install equipment, piping, wiring/conduit parallel to building lines (i.e. horizontal, vertical, and parallel to walls) wherever possible.

B. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

C. Install all equipment in readily accessible location as defined by Chapter 1 Article 100 part A of the NEC. Control panels shall be attached to structural walls unless mounted in equipment enclosure specifically designed for that purpose. Panels shall be mounted to allow for unobstructed access for service.

D. Verify integrity of all wiring to ensure continuity and freedom from shorts and grounds.

E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.02 WIRING

A. All control and interlock wiring shall comply with the national and local electrical codes and Division 26 of these Specifications. Where the requirements of this Section differ with those in Division 26, the requirements of this Section shall take precedence.

B. Do not install Class 2 wiring in conduit containing Class 1 wiring. Do not use boxes and panels containing high voltage for low voltage wiring except for the purpose of interfacing the two (e.g. relays and transformers).

C. Control wiring located in a plenum space that is not installed in a conduit shall be plenum rated.

D. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to wire connections shall be at a terminal blocks, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

E. Maximum allowable voltage for control wiring shall be 120V. Provide and install step down transformers.

F. All wiring shall be installed as continuous lengths, where possible. Any required splices shall be made only within an approved junction box or other approved protective device.

G. Maintain fire rating at all penetrations in accordance with other Sections of this Specification and local codes.

H. Size of conduit and size and type of wire shall be the design responsibility of the Contractor, in keeping with the manufacturer's recommendations and the NEC.

I. Locate control and status relays in designated enclosures only. These relays may also be located within packaged equipment control panel enclosures. These relays shall not be located within Class 1 starter enclosures.

J. Follow manufacturer's installation recommendations for all communication and network cabling. Network or communication cabling shall be run separately from other wiring.

K. Adhere to Division 26 requirements for installation of raceway.

L. Maintain an updated (as-built) wiring diagram with terminations identified at the job site.

M. Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 3feet in length and shall be supported at each end. Flexible metal conduit less than 1/2" electrical trade size shall not be used. In areas exposed to moisture liquid tight, flexible metal conduits shall be used.

3.03 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequate for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. All wires attached to sensors shall be air sealed in their conduits or in the wall to stop air transmitted from other areas affecting sensor readings.

E. Install duct static pressure tap with tube end facing directly down-stream of air flow.

F. Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip.

G. All pipe mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat conducting fluid in thermal wells.

H. Wiring for space sensors shall be concealed in building walls. EMT conduit is acceptable within mechanical and service rooms.

I. Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

3.04 FLOW SWITCH INSTALLATION

A. Install using a thread-o-let in steel pipe. In copper pipe use C x C x F Tee, no pipe extensions or substitutions allowed.

B. Mount a minimum of 5 pipe diameters upstream and 5 pipe diameters downstream or 2 feet which ever is greater, from fittings and other obstructions.

C. Install in accordance with manufacturers' instructions.

D. Assure correct flow direction and alignment.

E. Mount in horizontal piping - flow switch on top of the pipe.

3.05 ACTUATOR INSTALLATION

A. Mount and link control damper actuators per manufacturer's instructions.

B. To compress seals when spring return actuators are used on normally closed dampers, power actuator to approximately 5 degrees open position, manually close the damper, and then tighten the linkage.

C. Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

D. Valves - Actuators shall be mounted on valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following manufacturer's recommendations.

3.06 WARNING LABELS

A. Affix plastic labels on each starter and equipment automatically controlled. Label shall indicate the following:

C A U T I O N This equipment is operating under automatic control and may start at any time without warning.

3.07 IDENTIFICATION OF HARDWARE AND WIRING

A. All wiring and cabling, including that within factory-fabricated panels, shall be labeled at each end within 2 inches of termination with a cable identifier and other descriptive information.

B. Permanently label or code each point of field terminal strips to show the instrument or item served.

C. Identify control panels with minimum 1-cm letters on laminated plastic nameplates.

D. Identify all other control components with permanent labels. Identifiers shall match record documents. All plug-in components shall be labeled such that removal of the component does not remove the label.

3.08 CLEANING

A. The Contractor shall clean up all debris resulting from his or her activities daily. The contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated by the Construction Manager or General Contractor.

B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.

C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

3.09 PROTECTION

A. The Contractor shall protect all work and material from damage by his/her work or workers, and shall be liable for all damage thus caused.

B. The Contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The Contractor shall protect his/her work against theft or damage, and shall carefully store material and equipment received on site that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.10 FIELD QUALITY CONTROL

A. All work, materials and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this Section.

B. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. All visible piping and or wiring runs shall be installed parallel to building lines and properly supported.

C. Contractor shall arrange for field inspections by local and/or state authorities having jurisdiction over the work.

3.11 ACCEPTANCE

A. The control systems will not be accepted as meeting the requirements of completion until all tests described in this Specification have been performed to the satisfaction of both the Engineer and Owner.

B. The full range of operation for all Sequences of Operation shall be demonstrated. Where sequences are dependent on season or outside conditions these conditions may be simulated for the purpose of demonstration if approved by both the Architect/Engineer and the Owner. If simulations cannot be acceptably created the Contractor shall perform the demonstration during the proper period.

C. Any tests that cannot be performed due to circumstances beyond the control of the Contractor may be exempt from the Completion requirements if stated as such in writing by the Owner's representative. Such tests shall then be performed as part of the warranty.

END OF SECTION 230991

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Work specified as part of this Section consists of the work required to achieve operational and coordinated Sequences of Operation as described. Work includes coordination of functions of controllers supplied as part of equipment packages, sizing of control valves, interconnection of systems, provision and installation of all accessory devices required for complete system operation including devices not provided as part of equipment, coordination of start up and testing and demonstration of the operation of Sequences of Operation to the Owner and his representatives.

B. The control system operation of all equipment shall be subject to the operational modes, conditions and logic described in this Section and the controlled equipment manufacturer's recommendations.

C. Training of the Owner's personnel in the operation, trouble shooting, adjustment and repair of all system controls.

1.02 RELATED SECTIONS AND WORK

A. Section 230923 - Automatic Temperature Controls and Building Automation System

B. Section 230991 - Instrumentation and Control Integration

C. Division 26 - Electrical Specifications

D. Owner's Building Management System (BMS)

E. Owner's Fire Alarm System (FAS)

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. General
   1. Conform to the requirements of the Owner's standards for all electrical work and devices.
   2. System and system components shall be BACNet compatible.
   3. All set points and operating points shall be able to be transmitted to and set from the BMS system. Specific points to be enabled shall be at the discretion of the Owner.
   4. All systems shall be capable of operating independently of the BMS system based on set points and limits either input from the BMS system or manually.
   5. Coordinate all work with the requirements and characteristics of the BMS system and the equipment provided for the project under this phase or earlier phases.
   6. All space sensors and thermostats shall have an LCD display indicating their set point, the condition sensed and the mode of operation they are responding to.
   7. All equipment to be integrated with the BMS shall be fully integrated with new or existing facility controls and devices including interlocks, icons, graphics, read-outs and reports.

3.02 SEQUENCE OF OPERATION - EXHAUST FANS, TE-X

A. General:

1. The exhaust fan shall run continuously 24 hours a day, 7 days a week.

3.03 SEQUENCE OF OPERATION - SPLIT SYSTEM DEDICATED OUTDOOR AIR UNIT, DOAS-1/DOAS-2

A. Run Conditions - Scheduled:
   1. The unit shall run according to a user definable time schedule.

B. Outside Air Damper:
   1. The outside air damper shall open anytime the unit runs and shall close anytime the unit stops. The supply fan shall start only after the damper status has proven the damper is open.
   2. The outside air damper shall close 4sec (adj.) after the supply fan stops.
   3. Alarms shall be provided as follows:
      a. Outside Air Damper Failure: Commanded open, but the status is closed.
      b. Outside Air Damper in Hand: Commanded closed, but the status is open.

C. Supply Fan:
   1. The supply fan shall run anytime the unit is commanded to run. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime, unless shutdown on safeties.
   2. Alarms shall be provided as follows:
      a. Supply Fan Failure: Commanded on, but the status is off.

D. Zone Temperature Control:
   1. The controller shall monitor the supply air temperature and shall maintain a supply air temperature of 70 degrees.

E. Hot Gas Reheat Mode:
   1. When the supply fan is running and the unit is in Cooling mode the system monitors the leaving air temperature.
   2. The leaving air temperature will typically be within approximately ± 0.5 degree F of the leaving air temperature set point.
   3. If the leaving air temperature is greater than 72 degree F, then the hot gas reheat mode will be disabled.

F. Dehumidification:
   1. If the leaving air temperature set point is achieved, the controller will check leaving air humidity.
   2. If the leaving air humidity is 3% above the leaving air humidity set point, 60% RH, the digital compressor will ramp up in capacity as necessary to satisfy the leaving air humidity set point.
   3. If the leaving air temperature goes below the set point, modulating hot gas reheat will be enabled to maintain the leaving air temperature. The controlled will balance the capacity of the compressor and the use of hot gas reheat to first satisfy leaving air temperature and then, if necessary dehumidify.

G. Prefilter Status:
   1. The controller shall monitor the prefilter status.
   2. Alarms shall be provided as follows:
      a. Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adj.).

H. Supply Air Temperature:
   1. The controller shall monitor the supply air temperature.
   2. Alarms shall be provided as follows:

a. High Supply Air Temp: If the supply air temperature is greater than 120 degree F (adj.).
b. Low Supply Air Temp: If the supply air temperature is less than 45 degree F (adj.).

I. System Points

	Hardware Points				Software Points						
Point Name	AI	AO	BI	BO	AV	BV	Loop	Sched	Trend	Alarm	Show On Graphic
Supply Air Temp	x								x		x
Modulating Gas Heat		x							x		x
Outside Air Damper Status			x						x		x
Supply Fan Status			x						x		x
Prefilter Status			x						x		
Outside Air Damper				x					x		x
Supply Fan Start/Stop				x					x		x
Cooling Stage 1				x					x		x
Cooling Stage 2				x					x		x
Supply Air Temp Set Point					x				x		x
Outside Air Damper Failure										x	
Supply Fan Failure										x	
High Supply Air Temp										x	
Low Supply Air Temp										x	
Totals	**1**	**1**	**3**	**4**	**1**	**0**	**0**	**0**	**10**	**4**	9

Total Hardware (12) **Total Software (18)**

3.04 SEQUENCE OF OPERATION - VARIABLE REFRIGERANT FLOW (VRF) UNITS

A. Cooling Operation:
1. The unitary controller will call for cooling when measured room temperature is 1.8FDB above setpoint and adjust refrigerant flow and capacity based on differential from setpoint. The unit will remain in an active call for cooling until the measured room temperature is 1.8FDB below setpoint.
2. The indoor fan will operate based on user selected fan speed setting at the unitary controller and will allow for High, Medium, and Low selection. The fan speed will remain constant in the cooling mode regardless of the cooling cycle being called for.
3. (User fan speed control should be disabled in applications where OA is ducted into the terminal unit)

B. Heating Operation
1. The unitary controller will call for heating when measured room temperature is 1.8FDB below setpoint and adjust refrigerant flow and capacity based on differential from setpoint. The unit will remain in an active call for heating until the measured room temperature is 1.8FDB above setpoint.
2. The indoor fan will operate based on user selected fan speed setting at the unitary controller and will allow for High, Medium, and Low selection. The fan speed will remain constant during heating/and or cooling operation.

C. Mode Changeover
   1. Mode changeover shall be configured through the Building Management System controller.

END OF SECTION 230993

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the pipe, valves, fittings, and joining materials for use with the piping systems described in this Section and as shown on the Drawings.

1.02 RELATED DOCUMENTS

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

B. Section 079201 - Non-Fire Rated Sleeves and Seals

C. Section 230529 - Pipe Hangers and Supports

D. Section 230555 - Mechanical System Identification

E. Section 230700 - Pipe Insulation

F. Section 232007 - Piping Specialties

1.03 ABBREVIATIONS

A. The following are standard abbreviations:
   1. CWP: Cold working pressure.
   2. EPDM: Ethylene-propylene-diene-terpolymer rubber.
   3. NRS: Nonrising stem.
   4. OS&Y: Outside screw and yoke.
   5. PTFE: Polytetrafluoroethylene plastic.
   6. SWP: Steam working pressure.
   7. TFE: Tetrafluoroethylene plastic.
   8. NPS: Nominal Pipe Size

1.04 SUBMITTALS

A. Product Data: For each type of valve indicated: Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

B. Product data on pipe, fittings, gaskets, and bolts. Include dimensions, specifications, and manufacturer. Provide pipe and valve application schedule.

C. Provide product data, including but not be limited to dimensions, specifications, manufacturer, installation and operation instructions, temperature and pressure ratings, end connections, and required clearances on piping specialties included in this Specification.

D. Welder Certifications - Furnish the names of pipe welders and welding operators employed by the Contractor to perform the Work who have been qualified to use the welding procedures which have been qualified in accordance with the specified pressure piping codes or AWS or NFPA standards.

E. Shop Drawings
   1. Where deviations from the Drawings and Specifications are proposed for any reason, submit shop drawings identifying proposed deviations showing layout of all piping, fittings,

materials, dimensions, and fabrication and installation details. Submit a comparison table of the specified features and ratings of the specified item and those of the proposed deviation to allow a direct comparison.

2. The review of deviations will be for pressure drop only. The review will not address clearances or accessibility. No dimensional or coordination check will be made.
3. The Contractor has the sole responsibility to review the Drawings, coordinate piping fabrication, and provide clearances and access for installation, maintenance and balancing of this Work, and Work of other trades. Unless specifically dimensioned, Drawings indicate approximate locations only. The Contractor has the sole responsibility to locate and route the piping.
4. Submit all layout shop drawings on not less than ¼ inch equals 1 foot scale drawings.

1.05 REFERENCES

A. Division 1 - Quality Control: Requirements for references and standards.

B. AGA Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

C. ANSI C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

D. ASME B16.3 - Malleable Iron Threaded Fittings.

E. ASME B16.5 - Steel Pipe Flanges and Flanged Fittings

F. ASME B16.9 - Factory-Made Wrought Steel Buttwelding Fittings

G. ASME B16.15 - Cast Bronze Threaded Fittings

H. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

I. ASME B16.22 - Wrought Copper and Bronze Solder Joint Pressure Fittings.

J. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

K. ASME B16.24 - Cast Copper Alloy Pipe Flanges and Flanged Fittings.

L. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

M. ASME B16.39 - Pipe Unions, Malleable Iron Threaded

N. ASME-B31.1 - Power Piping.

O. ASME B31.2 - Fuel Gas Piping.

P. ASME B31.5 - Refrigeration Piping.

Q. ASME B31.9 - Building Service Piping.

R. ASME B36.10M - Welded and Seamless Wrought Steel Pipe

S. ASME SEC IV - Construction of Heating Boilers.

T. ASME SEC IX - Welding and Brazing Qualifications.

U. ASTM A47 - Ferritic Malleable Iron Castings

V. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

W. ASTM A74 - Cast Iron Soil Pipe and Fittings.

X. ASTM A105 - Forgings, Carbon Steel, for piping components.

Y. ASTM A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings

Z. ASTM A181 - Forgings, Carbon Steel, for General Purpose Piping

AA. ASTM A197 -Cupola Malleable Iron

AB. ASTM A234/A234M - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

AC. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile

AD. ASTM B32 - Solder Metal.

AE. ASTM B42 - Seamless Copper Pipe.

AF. ASTM B62 - Composition Bronze or Ounce Metal Castings

AG. ASTM B75 - Seamless Copper Tube

AH. ASTM B88 - Seamless Copper Water Tube.

AI. ASTM B306 - Copper Drainage Tube (DWV).

AJ. ASTM B584 - Copper Alloy Sand Castings for General Applications

AK. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

AL. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

AM. AWS A5.8 - Specification for Brazing Filler Material

AN. AWWA C651 - Disinfecting Water Mains.

AO. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

AP. NFPA 30 - Flammable and Combustible Liquids Code

AQ. NFPA 54 - National Fuel Gas Code.

AR. NSF 61 - Domestic Water Pipe, Valves, and Fittings.

AS. Mechanical Code of New York State-Latest Edition

AT. Plumbing Code of New York State-Latest Edition

AU. Fuel Gas Code of New York State-Latest Edition

AV. FM - Factory Mutual Compliance

AW. UL - Underwriter's Laboratory Compliance

1.06 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, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug 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 hand wheels or stems as lifting or rigging points.

D. Protect all flange faces with wood, plastic or soft metal to prevent damage to parts.

E. Protect all pipe threads from damage with plastic plugs or caps.

F. Mark and identify all piping materials in accordance with the Reference Standards specified herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. When two or more valves of the same type are used in the same service, furnish all valves of this type from the same manufacturer.

B. Specific manufacturer's model numbers are cited in the following Piping Material Schedules to establish the desired quality and performance for each type valve or material. Equivalent products by other approved manufacturers are also acceptable. Approval shall be subject to review by the Architect/Engineer.

2.02 FUEL OIL SUPPLY AND RETURN (ABOVE GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Schedule 40 seamless, ASTM A 53 Grade B	Wheatland
Joints	2 inches & smaller 2 ½ inches & larger	Threaded Connections Welded Connections	
Fittings	2 inches & smaller 2 ½ inches & larger	150#, malleable iron, ASME B16.3 Standard weight, seamless steel, butt weld, ASTM A234	Anvil Weldbend
Flanges	2 ½ inches & larger	150#, weld neck, bore to match pipe ID, ASTM A181	Weldbend

Item	Pipe Size	Description	Manufacturer/ Model No.
Bolts	All Sizes	Alloy Steel, Hex Head Bolts and Nuts, ASTM A307 Grade B	
Unions	2 inches & smaller	150#, malleable iron, brass trim, threaded ends, ASTM A197	Anvil
Gaskets	All Sizes	Spiral wound metallic gaskets	Flexitallic Style LS/LSI
Swing Check Valves	2 inches & smaller 2 ½ inches & larger	Class 125, Y-pattern swing type, threaded connections, bronze body with TFE seat disc. MSS-SP80, ASTM B 62 Class 125, swing type, flanged connections, cast iron body with bronze trim, non asbestos gasket. MSS-SP71, ASTM A 126 Class B	Nibco T413-Y Nibco F018-B
Ball Valves	2 inches & smaller	Two-Piece, Full-Port, threaded ends, bronze body, Type 316 stainless-steel vented ball and stem, reinforced TFE seats, threaded body pack nut design adjustable stem packing, blowout proof stem, 150 psig SWP and 600-psig CWP ratings. MSS SP-110, ASTM B 584 Alloy C84400, ASME B1.20.1	Nibco T-585-70-66
Butterfly Valves	2 ½ inches & larger	Single-Flange, 200-psig CWP Rating, full-lug type with ductile-iron body, one-piece type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat. Valve sizes 2 ½" through 6" shall have lever lock operator; valve sizes 8" and larger shall have weatherproof gear operator	Nibco LD-2000-3/5
Combination Fusible Link & Shutoff Valve	All sizes	Threaded ends, quick closing, spring loaded and thermally actuated fusible element which melts at 165° F causing the valve to close tightly	Preferred Utilities Fusomatic Gate Valve
Anti-Syphon Valve	Anti-Syphon Valve	The valve shall automatically shut off the oil flow in the event of a broken or inadvertently left open oil suction line. In the event of a fire, to avoid thermal expansion induced valve failure the Anti-syphon valve body material must be bronze. UL Listed and labeled	Preferred Utilities

2.03 DOMESTIC WATER (ABOVE GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Type L, hard drawn copper tubing, ASTM B88	Mueller Industries
Joints	All sizes	Lead-free solder, ASME B32; Water Soluble Flux, ASTM B-813	J.W. Harris-Bridgit
Fittings	All sizes	Cast copper alloy or wrought copper ASME B16.18 or ASME B16.22	Nibco
Flanges	4 inches & larger	150#, cast copper, ASME B16.24	Nibco

Item	Pipe Size	Description	Manufacturer/ Model No.
Bolts	All Sizes	Alloy Steel, Hex Head Bolts and Nuts, ASTM A307 Grade B	
Unions	3 inches & smaller	Wrought copper, solder unions, ASME B16.22	Nibco
Dielectric Unions	3 inches & smaller	Dielectric Type, Copper to Steel	Watts Regulator Series 3000
Gaskets	All sizes	Non-asbestos, fiber sheet	Flexitallic
Ball Valves	2 inches & smaller	Two-piece, full-port, soldered or threaded ends, bronze body, type 316 stainless-steel vented ball and stem, reinforced TFE seats, 150 psig SWP and 600-psig CWP ratings. MSS SP-110, ASTM B 584 Alloy C84400, ASME B1.20.1	Nibco T-585-70-66 or S-585-70-66

2.04 DOMESTIC WATER (BELOW GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Type K, hard drawn copper tubing, ASTM B88	Mueller Industries
Joints	All sizes	Lead-free solder, ASME B32; Water Soluble Flux, ASTM B-813	J.W. Harris-Bridgit
Fittings	All sizes	Cast copper alloy or wrought copper ASME B16.18 or ASME B16.22	Nibco
Flanges	4 inches & larger	150#, cast copper, ASME B16.24	Nibco
Bolts	All sizes	Alloy Steel, Hex Head Bolts and Nuts, ASTM A307 Grade B	
Unions	3 inches & smaller	Wrought copper, solder unions, ASME B16.22	Nibco
Dielectric Unions	3 inches & smaller	Dielectric Type, Copper to Steel	Watts Regulator Series 3000
Gaskets	All sizes	Non-asbestos, fiber sheet	Flexitallic
Ball Valves	2 inches & smaller	Two-piece, full-port, soldered or threaded ends, bronze body, type 316 stainless-steel vented ball and stem, reinforced TFE seats, 150 psig SWP and 600-psig CWP ratings. MSS SP-110, ASTM B 584 Alloy C84400, ASME B1.20.1	Nibco T-585-70-66 or S-585-70-66
Butterfly Valves	2 ½ inches & larger	Full-lug type with ductile-iron body, one-piece Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat. Valve sizes 2 ½" through 6" shall have lever lock operator; valve sizes 8" and larger shall have weatherproof gear operator. MSS SP-67	Nibco LD-2000-3/5

2.05 NATURAL GAS PIPING IN SCHOOLS (ABOVE GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Schedule 40 seamless, ASTM A 53 Grade B	Wheatland
Joints	2 1/2 inches & smaller 3 inches & larger	Threaded connections Welded connections	
Fittings	2 1/2 inches & smaller 3 inches & larger	Threaded Joints - 150#, malleable iron, ASTM B16.3 Welded Joints - Standard weight, seamless steel, butt weld, ASTM A234	Anvil Weldbend
Valves	All sizes	Class 150, bronze body, full port, bronze plug, non-lubricated, PTFE sleeve, threaded connections, steel wrench	Mueller Steam Specialty non-lubricated sleeved plug valve

2.06 NATURAL GAS PIPING (ABOVE GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Schedule 40 seamless, ASTM A 53 Grade B	Wheatland
Joints	3 ½ inches & smaller at pressure 14 inches w.c. & less 4 inches & larger at pressures 14 inches w.c. & less; or all pipe sizes at pressure greater than 14 inches w.c.	Threaded connections Welded connections	
Fittings	3 ½ inches & smaller at pressure 14 inches w.c. & less 4 inches & larger at pressures 14 inches w.c. & less; or all pipe sites at pressure greater than 14 inches w.c.	Threaded Joints - 150#, malleable iron, ASTM B16.3 Welded Joints - Standard weight, seamless steel, butt weld, ASTM A234	Anvil Weldbend
Valves	All sizes	Class 150, bronze body, full port, bronze plug, non-lubricated, PTFE Fluorocarbon sleeve, threaded, steel wrench	Mueller Steam Specialty Non Lubricated Plug Valves

2.07 NATURAL GAS PIPING (BELOW GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.

Pipe	All sizes	Schedule 40 seamless, ASTM A 106	Wheatland
Joints	All sizes	ANSI B31.2	
Fittings	All sizes	ASTM A234 forged steel welding type, with AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape	
Corrosion Protection	All sizes	Magnesium anodes, 17 pounds	

2.08 SUMP DISCHARGE PIPING (ABOVE GROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	Up to 3 inches	Schedule 40 seamless, galvanized, ASTM A 53 Grade B	
Joints	Up to 3 inches	Threaded connections	
Fittings	Up to 3 inches	Galvanized cast iron, threaded fittings, ASME B16.12	
Gate Valves	Up to 3 inches	Class 125, threaded connections, rising stem, union bonnet, solid wedge, bronze body and wedge, non-asbestos packing and ductile iron hand wheel. MSS-SP80, ASTM B62	Nibco T-124
Check Valves	Up to 3 inches	Cast iron full flow check valve, threaded connections, rated at 50 psi at 130 degrees F. Neoprene polyester reinforced flapper with cast iron and brass backing plates and stainless steel fastener	Zoeller Unicheck 30-0163,0164, 0152,0160

2.09 CONDENSER WATER AND CHILLED WATER PIPING (INCLUDING EQUALIZER, OVERFLOW AND DRAIN LINES)

Item	Pipe Size	Description	Manufacturer/ Model No.
Piping	All sizes	Schedule 40, seamless steel, ASTM A 53 Grade B	Wheatland
Joints	2 inches & smaller 2 ½ inches & larger	Threaded Connections Welded Connections	
Fittings	2 inches & smaller 2 ½ inches & larger	150#, malleable iron, threaded, ASME B16.3 Standard Weight, Seamless steel, butt welded, ASTM A234	Anvil Weldbend
Flanges	2 ½ inches & larger	150#, forged steel, weld neck, bore to match pipe ID, ASTM A181	Weldbend
Bolts	All sizes	Alloy Steel, Hex Head Bolts and Nuts, ASTM A307 Grade B	
Unions	2 inches & smaller	150#, malleable iron, brass trim, threaded ends ASTM A197, ASME B16.3	Anvil

Item	Pipe Size	Description	Manufacturer/ Model No.
Gaskets	All Sizes	Spiral wound metallic gaskets	Flexitallic Style LS/LSI
Gate Valves	2 inches & smaller	Class 125, threaded connections, rising stem, union bonnet, solid wedge, bronze body and wedge, non-asbestos packing and ductile iron hand wheel. MSS-SP80, ASTM B62	Nibco T-124
	2 ½ inches & larger	Class 125, flanged connections, OS & Y, cast-iron body and bonnet, bronze trim, solid-wedge disc, 200 psig CWP rating. ASTM A-126 Class B	Nibco F-617-O
Swing Check Valves	2 inches & smaller	Class 125, Y-pattern swing type, threaded connections, bronze body with TFE seat disc. MSS-SP80, ASTM B 62	Nibco T413-Y
	2 ½ inches & larger	Class 125, swing-type, flanged connections, cast iron body with bronze trim, non asbestos gasket. MSS-SP71, ASTM A-126 Class B	Nibco F918-B
Ball Valves	2 inches & smaller	Two-Piece, full-Port, threaded connections, bronze body, chrome-plated brass/bronze ball, TFE seats, separate packnut with adjustable stem packing, anti-blowout stem, 150 psig SWP and 600-psig CWP ratings. MSS SP-110, ASTM B584 Alloy C84400	Nibco T-585-70
Butterfly Valves	2 ½ inches & larger	Full-lug type with ductile-iron body, one-piece Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat. Valve sizes 2 ½" through 6" shall have lever lock operator; valve sizes 8" and larger shall have weatherproof gear operator. MSS SP-67	Nibco LD-2000-3/5
Balancing Valves	2 inches & smaller	Provide ball or globe style with flow balancing and shut-off capabilities, memory stops, and minimum two metering ports. Female sweat, NPT threaded, or press connections to match system piping. Bronze, brass or steel construction consistent with system temperature and pressure. Minimum design operating pressure of 175 psig. Provide with upstream strainer.	Armstong CBV B&G Circuit Setter IMI STAS/STAD

Item	Pipe Size	Description	Manufacturer/ Model No.
Balancing Valves	2 ½ inches & larger	Valve shall be of cast iron construction with 125 psi ANSI flanged connections suitable up to 175 psi working pressure. Valves 2-1/2"-3" pipe shall have a brass ball with glass and carbon filled TFE seat rings. Valves 4"-12" shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve setting. Valves to be leak-tight at full rated working pressure. Design pressure and temperature shall be 175 psig at 250 deg F. Provide with upstream strainer.	Bell and Gossett Circuit Setter

2.10 COMPRESSED AIR PIPING

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Type K, hard drawn copper tubing, ASTM B88	Mueller Industries
Joints	All sizes	AWS A5.8, Class BCuP-5, Silver alloy	J.W. Harris-Stay Silv 15 or Dynaflow Brazing Filler Metal
Fittings	All sizes	Cast copper alloy or wrought copper ASME B16.18 or ASME B16.22	Nibco
Flanges	4 inches & larger	150#, Cast Copper, ASME B16.24	Nibco
Bolts	All Sizes	Alloy Steel, Hex Head Bolts and Nuts, ASTM A307 Grade B	
Unions	3 inches & smaller	Wrought copper, solder unions, ASME B16.22	Nibco
Dielectric Unions	3 inches & smaller	Dielectric Type, Copper to Steel	Watts Regulator Series 3000
Gaskets	All Sizes	Spiral wound metallic gaskets	Flexitallic Style LS/LSI
Ball Valves	2 inches & smaller	Two-piece, full-port, soldered or threaded ends, bronze body, type 316 stainless-steel vented ball and stem, reinforced TFE seats, 150 psig SWP and 600-psig CWP ratings. MSS SP-110, ASTM B 584 Alloy C84400, ASME B1.20.1	Nibco T-585-70-66 or S-585-70-66

Item	Pipe Size	Description	Manufacturer/ Model No.
Butterfly Valves	2 ½ inches & larger	Full-lug type with ductile-iron body, one-piece Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat. Valve sizes 2 ½" through 6" shall have lever lock operator; valve sizes 8" and larger shall have weatherproof gear operator. MSS SP-67	Nibco LD-2000-3/5

2.11 HEATING HOT WATER PIPING

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	2 inches and smaller 2 ½ inches and larger	Type L, hard drawn copper tubing, ASTM B88 Schedule 40, seamless steel, ASTM A 53 Grade B	Mueller Industries Wheatland
Joints	2 inches and smaller 2 ½ inches and larger	Lead-free solder, ASME B32; Water Soluble Flux, ASTM B-813 Welded Connections	J.W. Harris-Bridgit
Fittings	2 inches and smaller 2 ½ inches and larger	Cast copper alloy or wrought copper ASME B16.18 or ASME B16.22 Standard Weight, Seamless steel, butt welded, ASTM A234	Nibco Weldbend
Flanges	2 ½ inches and larger	150#, forged steel, weld neck, bore to match pipe ID, ASTM A181	Weldbend
Bolts	All sizes	Alloy Steel, Hex Head Bolts and Nuts, ASTM A307 Grade B	
Unions	2 inches & smaller	Wrought copper, solder unions, ASME B16.22	Nibco
Dielectric Unions	2 1/2 inches & smaller	Dielectric Type, Copper to Steel	Watts Regulator Series 3000
Gaskets	All Sizes	Spiral wound metallic gaskets	Flexitallic Style LS/LSI
Ball Valves	2 inches & smaller	Two-piece, full-port, soldered ends, bronze body, type 316 stainless-steel vented ball and stem, reinforced TFE seats, 150 psig SWP and 600-psig CWP ratings. MSS SP-110, ASTM B 584 Alloy C84400, ASME B1.20.1	Nibco S-585-70-66
Check Valves	2 inches & smaller 2 ½ inches & larger	Class 125, Y-pattern swing type, soldered connections, bronze body with TFE seat disc. MSS-SP80, ASTM B 62 Class 125, swing-type, flanged connections, cast iron body with bronze trim, non asbestos gasket. MSS-SP71, ASTM A-126 Class B	Nibco S413-Y Nibco F918-B

Item	Pipe Size	Description	Manufacturer/ Model No.
Butterfly Valves	2 ½ inches & larger	Full-lug type with ductile-iron body, one-piece Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat. Valve sizes 2 ½" through 6" shall have lever lock operator; valve sizes 8" and larger shall have weatherproof gear operator. MSS SP-67	Nibco LD-2000-3/5
Balancing Valves	2 inches & smaller	Provide ball or globe style with flow balancing and shut-off capabilities, memory stops, and minimum two metering ports. Female sweat, NPT threaded, or press connections to match system piping. Bronze, brass or steel construction consistent with system temperature and pressure. Minimum design pressure and temperature shall be 175 psig at 250 deg F. Provide with upstream strainer.	Armstrong CBV B&G Circuit Setter IMI STAS/ATAD
Balancing Valves	2 ½ inches & larger	Valve shall be of cast iron construction with 125 psi ANSI flanged connections suitable up to 175 psi working pressure. Valves 2-1/2"-3" pipe shall have a brass ball with glass and carbon filled TFE seat rings. Valves 4"-12" shall be fitted with a bronze seat, replaceable bronze disc with EPDM seal insert, and stainless steel stem. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplate to assure specific valve setting. Valves to be leak-tight at full rated working pressure. Design pressure and temperature shall be 175 psig at 250 deg F. Provide with upstream strainer.	Bell and Gosset Circuit Setter

2.12 SANITARY DRAIN PIPING (BELOWGROUND)

Item	Pipe Size	Description	Manufacturer/ Model No.
Pipe	All sizes	Service weight cast iron soil pipe, ASTM A74	Charlotte pipe
Joints	All sizes	Push-on, bell and spigot ends, ANSI C111	
Fittings	All sizes	Cast iron hub and spigot fittings or Cast iron no-hub fittings, ASTM A74	Charlotte pipe
Gaskets	All sizes	Neoprene compression type gasket, ASTM C 564	Charlotte pipe

2.13 PNEUMATIC CONTROLS PIPING

A. Material:
   1. Copper: Seamless copper tubing, with copper or brass solder fittings and Type I solder.
   2. Non-metallic: Virgin polyethylene tubing, conforming to ASTM Type 1, Grade 5, Class B or C meeting stress crack test in accordance with ASTM D1693. For individual air tubes in

multi-tube instrument tubing harnesses conform to the above, complete with a Mylar barrier and a solid vinyl outer jacket a minimum of .062" thick. Brass, aluminum or delrin fittings, of the compression or barb push-on type, designed for instrument service.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Unless otherwise shown, route piping in the most direct manner parallel to building lines in accordance with the Drawings. Group piping whenever practical at common elevations.

B. Accurately align, support and connect piping without forcing.

C. Locate piping so that access to and clearance around equipment, and minimum piping headroom of 6'-8" is maintained, except where otherwise shown.

D. Space piping so that insulation and flanges, if any, have at least 1 inch clearance after maximum movement.

E. Where pipe elevations are not shown, pitch supply and return lines to positive drain points and/or coils.

F. Provide accessible flanges or union connections on the supply and return connections of terminal equipment and other items which must be disconnected for maintenance. Where unions are furnished as an integral part of the equipment, additional unions are not required unless required for access to or removal of components. Arrange equipment piping connections so that maintenance can be made without removing large sections of pipe or relocating the equipment.

G. In Domestic Water Systems, connect branch lines to the top of the line. For all other liquid systems, connect branch lines to the bottom or lower half of the line, preferably the bottom.

H. Connect branch lines in steam service and compressed air to the top or upper half of the line, preferably the top.

I. Use fittings for all changes of direction. Bending of steel pipe is not permissible.

J. Clean all piping materials before installation to remove grease, loose dirt, mill scale and other foreign matter.

K. Provide air vents at all high points of water piping, and valved drains at all low points of water piping for complete venting, draining and flushing of the piping system. Locate and provide air vents at multiple high points that are necessary to prevent air binding in the piping system. Install additional air vents and drains if directed by the Architect/Engineer, at no cost to the Owner. As a minimum provide drains and air vents
   1. In each section of piping separated by valves.
   2. On all coils.
   3. For each riser, where riser or runout to riser has a valve installed.
   4. In low point of piping to each down fed convector or radiator.

L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide loops, pipe offsets and anchors.

M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

N. Install gate or ball valves for shut-off and to isolate equipment, parts of systems, or vertical risers.

O. Sleeve pipes passing through partitions, walls and floors.

P. Identify piping under provisions of “Mechanical System Identification” Specification.

Q. Provide escutcheons at all locations where piping installed exposed to view penetrates wall, partitions, floors and ceilings.

R. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

S. Install flexible connectors at inlet and discharge connections of pumps and other vibration producing equipment.

T. Install strainers on the supply side of each control valve, pressure regulating valve, solenoid valve, trap, and elsewhere as indicated.

U. For pressurized liquid piping systems installed horizontally make reductions in pipe sizes using eccentric reducer fitting installed with the level side up to allow air venting.

V. For all nipples up to and including six inches in length provide extra-heavy shoulder type. For all nipples over six inches in length provide corresponding material, quality and thickness as the pipe on which they are used. Do not use close nipples. Provide nipples with designation mark of the manufacturer conforming to the ASTM pipe specifications for system served.

W. Make connections to all cooling and heating units with single or multiple cooling or heating coils in accordance with the manufacturer’s instructions and labeling on equipment

X. For pressures over 15 psig, use nipples and caps instead of plugs for permanent closures. Plugs in equipment provided by equipment manufacturers are acceptable.

Y. Do not install piping above electrical panels. Route piping around panels.

3.02 STEAM AND CONDENSATE PIPING SYSTEMS

A. Install drip legs with steam traps at low points and natural drainage points in the steam system, such as at the ends of mains, bottoms of risers, and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.

B. On straight runs with no natural drainage points, install drip legs with steam traps at intervals not exceeding 150 feet where pipe is pitched down in the direction of the steam flow and a maximum of 100 feet where the pipe is pitched up so that condensate flow is opposite of steam flow.

C. Size drip legs same diameter as the main up to 6 inches. In steam mains 6 inches and larger, provide drip legs half the size of the distribution line but never less than 6 inches. The length of the drip leg; 1-1/2 times the diameter of the distribution line but not less than 18 inches.

D. Equip drip legs and dirt pockets with capped gate valves to allow removal of dirt and scale.

E. In piping systems installed horizontally, make reductions in pipe sizes using eccentric reducer fitting installed with the level side down.

F. Install steam supply piping at a uniform grade of 1/4 inch in ten feet downward in the direction of flow or toward the trap when a trap is present.

G. Install condensate return piping at a uniform grade of 1/2 inch in ten feet downward in the direction of flow.

H. Install automatic air vents at the end of all steam mains and headers, and on large equipment steam spaces to facilitate start-up and heat transfer. Locate the air vent at a high point of the piping system or equipment, or where the air collects. Pipe the outlet to a safe place, cut the pipe end at a 45 degree angle. Install an isolation valve upstream of automatic air vents.

3.03 NATURAL GAS PIPING SYSTEMS

A. Provide capped dirt legs, full size of piping, for gas piping as close to the inlet of equipment as practical.

B. Provide vent to outside at pressure regulators sized for pressure regulator failure.

C. Above grade outdoor threaded piping and fittings shall be galvanized.

D. Above grade outdoor welded piping and fittings shall be painted or provided with a coating and taping system in accordance with utility company requirements.

E. Below grade piping shall be provided with corrosion protection (Magnesium anodes in accordance with local gas utility installation requirements).

3.04 FUEL OIL PIPING SYSTEMS

A. Provide priming tees with caps at all locations on fuel oil suction lines where fuel oil pumps need manual priming.

B. Use joint compounds and piping components resistant to the corrosive action of fuel oil.

3.05 COMPRESSED AIR PIPING SYSTEMS

A. Where piping elevations are not shown, pitch all lines to positive drain points. Unless shown otherwise on the Drawings include a line size drip leg with 2 line size drain valves and a hose end connection at all drain points.

B. Inspect, clean, cap and tag all piping at the end of each working day.

C. If copper tubing connections are specified in the piping schedule, comply with the following:
   1. Braze all joints in the tubing, except those permitted to be approved brass flared-type gas tubing fittings and those valves or equipment requiring screw connections, with 15 percent silver alloy using Handy Flux made by Hand and Harmon Company. Continuously back-purge all brazed joints back-purged with dry nitrogen or carbon dioxide to prevent the formation of scale within the tubing. Use preformed silver solder insert rings. Do not leave any excess flux inside the completed joints.

3.06 PNEUMATIC CONTROLS PIPING

A. Installation:
   1. Conceal all control systems air piping wherever possible. Copper air tubing in Mechanical Equipment, Steam Service, Machine and Boiler Rooms and Penthouse Mechanical Equipment Rooms may be installed exposed. Provide air piping a minimum of 1/4" O.D.,

with the exception that 1/8" O.D. seamless copper tubing will be permitted in branch runs to individual thermostats.

2. Provide hard temper copper tubing where exposed; concealed piping may be hard temper or soft annealed copper tubing. Run tubing parallel to the building lines. Bend tubing with bending tools. Use copper or brass solder type fittings, with the exception that all connections to apparatus or equipment must be made with compression or flare type fittings.
3. Support air tubing in an approved manner, with all overhead lines run parallel to each other, supported by clevis or trapeze hangers on maximum 5 foot centers, or by attachment to adjacent piping or electrical conduit.
4. Non-metallic air tubing may be used for temperature and humidity control systems, installed in accordance with the following:
    a. Run exposed non-metallic tubing in Mechanical Equipment, Steam Service and Machine Rooms, Penthouse Mechanical Equipment Rooms, Finished Rooms or Finished Spaces in E.M.T. Install hard temper copper tubing for individual terminal runs, with the exception of terminal runs less than one foot in length, in which case flexible polyethylene tubing may be used.
    b. Non-metallic multi-tube instrument tubing harness may be installed in concealed locations such as pipe chases, suspended ceilings or within wall construction. Single tube runs in the above locations shall be copper.
    c. Non-metallic tubing may be installed inside control panels, within air conditioner and unit ventilator enclosures and other similar locations as approved. Number or color code, neatly tie and support tubing. Neatly and securely fasten flexible tubing connections, bridging control cabinet and its panel door, along hinge side of door and protect from abrasion.
5. Periodically test all tubing during the piping installation. Prior to connection to control instruments or apparatus, blow out all tubing runs to rid system of dust, dirt and moisture, and test entire piping system under 40 lbs. air pressure for 24 hours, during which time pressure shall not drop more than 10 lbs.

3.07 THREADED CONNECTIONS

A. Ream pipe ends to remove burrs.

B. Use only standard ANSI taper threads. Threads shall be full, sharp, clean, and free of fins and burrs.

C. Apply joint sealing tape or paste to male threads only. Do not use paste on compressed air lines. When sealing fuel oil piping, use a thread-sealing compound suitable for oil when making up joints. When sealing natural gas piping, use a thread-sealing compound suitable for natural gas when making up joints.

D. Do not use close or short nipples of a size where the length of unthreaded pipe is less than the width of a pipe wrench.

E. Thredolets or similar code-approved fittings may be used for branch connections.

F. Provide unions at all threaded valve locations to facilitate the removal of the valve.

G. Joint Sealing Compound; Hercules, RectorSeal or approved equal.

3.08 WELDED CARBON STEEL CONNECTIONS

A. Perform welding using qualified welders and procedures following specified reference standards.

B. Do not use mitered welds for elbows.

C. Welded branch connections may be used in place of welding tees provided that requirements of the applicable ASME Code for pressure piping, B31.1 and/or B31.9 are met.

D. Weldolets or similar code-approved fittings may be used for branch connections.

E. Qualifications of welders, welding procedures, performance of welders and welding operators are required complying with the requirements of ASME B31.9 and ASME Boiler and Pressure Vessel Code, Section IX. Keep records and certifications required by code on file and available for inspection.

F. Whenever welding is done close to walls, floors or building structure, thoroughly clean the surfaces of weld splatter. Remove weld splatter from the surface of all welds, pipe and pipe supports.

G. Provide long radius pattern for welding elbows unless otherwise shown on the Drawings.

H. Examine and inspect welded pipe joints as follows:
   1. Visually examine all welded pipe joints for imperfections using qualified representatives. Submit qualifications to the Architect/Engineer.
   2. Make available to the Architect/Engineer records of visual examinations upon request.
   3. Remove weld defects by grinding or chipping and repair or replace joints in accordance with approved procedures.
   4. Make shop and field welded joints available to the Owner for nondestructive inspection and examination upon request.

3.09 FLANGED CONNECTIONS

A. Arrange flange bolt holes to straddle the pipe vertical and horizontal centerlines, and match the orientation of mating flanges.

B. Install piping to equipment without strain.

C. Provide gaskets at all flanged connections suitable for the design and temperature of the fluid contained, and in accordance with Part 2 of this Section.

D. Mate flat face flanges together and raised face flanges together.

3.10 COPPER TUBING CONNECTIONS

A. Provide soldered or brazed in accordance with Part 2 of this Section.

B. Make soldered and brazed connections in accordance with the procedures in the current edition of the Copper Tube Handbook of the Copper Development Association.

C. Qualifications of brazers, brazing procedures, and performance of brazers and brazing operators are required in compliance with the requirements of ASME B31.1, ASME B31.9, and the Boiler and Pressure Vessel Code, Section IX. Keep records and certifications required by the code on file and available for inspection.

D. Make solder joints on all copper water piping with 95/5 solder. Absolutely no lead-based solder will be accepted.

E. Clean joints thoroughly before soldering.

F. Remove excess solder and flux with a cloth or brush to leave a uniform clean fillet.

G. For refrigeration copper tubing connections, comply with ASME B31.5. Make brazed joints on all refrigeration piping.

3.11 CONNECTIONS OF DISSIMILAR METALLIC MATERIALS

A. Isolate connections between dissimilar metallic materials using dielectric connections. Use dielectric unions or flanges that provide a complete isolation of the two ends, including bolts for flanges, using materials suitable for the design pressure, temperature and fluid contained.

3.12 VALVES

A. Provide valves of the same size as the pipe in which they are installed, unless shown otherwise on the Drawings. At pumps, match valve size to pipe size and not pump connection size.

B. Install valves with the stem on or above the horizontal. Install valves with the stem horizontal if requirements of headroom, access or chain operation must be met.

C. Pack valves and adjust glands before final acceptance.

D. Install valve extension stems or chain operators where the center of valve hand wheels is more than 6 feet-6 inches above the floor and valve is 2 ½" and larger. Prove chain hooks where required to prevent fouling of chains on equipment and to clear walkways. Terminate chains approximately 3 feet-6 inches above the floor. Provide worm gear operators or impact hand wheels for all valves 6 inches and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation and a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.

F. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

G. Locate valves for easy access and provide separate support where necessary.

H. 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

I. Install butterfly valves with stems horizontal to allow support for the disc and the cleaning action of the disc.

J. 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.

K. Install balancing valves with lengths of straight pipe upstream and downstream of valve as per manufacturer's instructions such that calibrated accuracy is maintained As a minimum provide straight lengths as per the following table;

REQUIRED STRAIGHT LENGTHS

Valve Size	Upstream (In Pipe Diameters)	Downstream (In Pipe Diameters)
½"-3"	3	1

Valve Size	Upstream (In Pipe Diameters)	Downstream (In Pipe Diameters)
4”-12”	5	2

L. Chain wheel Actuators- Valve actuation assembly with sprocket rim, brackets, and chain.
   1. Sprocket rim with Chain guides: Ductile Iron (Aluminum for applications exposed to weather), of type and size required for valve.
   2. Brackets: Type, number, size, and fasteners required to securely mount actuator on valve.
   3. Chain: Stainless steel, of size required to fit sprocket rim.
   4. Manufacturers:
      a. Babbitt Steam Specialty Co.
      b. Roto Hammer Industries

3.13 CONTROL VALVE INSTALLATION

A. Install all control valves so that the stem position is not more than 60 degrees from the vertical up position.

B. Install valves in accordance with the manufacturer's recommendations.

C. Install control valves so that they are accessible and serviceable, and such that actuators may be serviced and removed without interference from structure or other pipes, ducts and/or equipment.

D. Install isolation valves at control valves such that control valve body may be serviced without draining the supply/return side piping system. Install unions at all connections to screwed type control valves.

3.14 PRESSURE TESTING, FLUSHING AND CLEANING

A. Pressure test piping systems in accordance with applicable codes and as described herein.

B. Pressure testing - Schedule pressure testing so that it may be witnessed by the Architect/Engineer, Owner, or their representative. Perform tests in accordance with the following procedures:
   1. Before testing, complete the installation of each pipe line, including final supports, hangers and anchors. Perform testing before insulation or paint is applied for examination during the test. Clean piping and equipment of metal cuttings and foreign matter as they are installed.
   2. Codes - Pressure test piping to assure integrity of material and workmanship in accordance with the applicable ASME Code for pressure piping (B31) and New York State Code.
   3. Protection of Equipment - Protect equipment, instruments and piping specialties which are not included in the test by either disconnecting from the piping and blanking off the end of the pipe with a blind flange, plug or cap, or isolating by insertion of a line blind or spool piece as required. Disconnect pneumatic control lines and close all openings.
   4. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
   5. Piping may be tested in sections or circuits as required for the progress of the work.
   6. Provide all systems to be pressurized with the appropriate gauges, certified calibrated by the manufacturer, and pressure-relieving devices.
   7. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test. Do not allow test pressure to exceed maximum pressure for any vessel, pump, valve, or other component in system under test.

8. Records - Provide records of all tests showing line designation, test pressure, ambient temperature, date of test, retests and signature of witness.

C. Pneumatic Test Procedures - Perform pneumatic testing in accordance with ASME B31.9
   1. Prior to application of full pneumatic test pressure, perform a preliminary test at 10 psig for a minimum of ten (10) minutes to reveal any major leaks.
   2. After the preliminary test, apply pressure gradually in stages until test pressure is reached.
   3. Test durations:
      a. For all systems the minimum test duration is that required to thoroughly examine the system for leaks.
      b. Natural gas piping; Maintain test pressure for a minimum of one hour but not less than ½ hour for each 500 cubic feet of pipe volume. After test, purge the entire system of test gas.
      c. For all other systems maintain test pressure for a minimum of ten (10) minutes without fluctuation.
   4. Check all joints, valves, etc. for leaks with a thick soap-water solution.
   5. Repair leaks as specified under “Repair of Line Leaks”.
   6. Repeat pneumatic test until there are no leaks.
   7. Ensure that adequate protection is provided to prevent injury to persons or property during leak testing.
   8. Test systems to the pressure indicated under “Pressure Testing Schedule”

D. Hydrostatic Test Procedures - Perform hydrostatic testing in accordance with ASME B31.9.
   1. Perform test using the pressure indicated under “Pressure Testing Schedule”
   2. After hydrostatic test pressure has been applied for at least two hours, examine piping, joints, and connections for leakage while maintaining test pressure. Repeat hydrostatic test until there are no leaks.
   3. Repair leaks as specified under “Repair of Line Leaks”

E. Service Testing - Perform service testing in accordance with ASME B31.9.
   1. For gases and steam and condensate service not over 15 psig, and for nontoxic, noncombustible, nonflammable liquids at pressures not over 100 psig and temperatures not over 200 degrees F a system test with the service fluid is acceptable. This exemption does not apply to natural gas piping.
   2. Bring the piping system up to operating pressure gradually with visual examination at a pressure between one-half and two-thirds of design pressure. Make a final examination at operating pressure.
   3. Repair leaks as specified under “Repair of Line Leaks”
   4. Repeat service test until there are no leaks.

F. Repair of Line Leaks - Comply with the following procedures for repair of leaks. In each case retest after repairs are made.
   1. Soldered/Brazed Joints - Remove solder/brazing alloy and reapply with proper flux.
   2. Flanged Joints - Check to determine flange end alignment and that all bolts are uniformly tightened with the required torque. If leak persists, depressurize the line, remove gasket, examine flange end face, and insert new gasket.
   3. Threaded Joints - Tighten joint to a required torque. If leak does not stop, replace pipe and/or fittings. Do not use pipe dope, cement or seal weld to stop pipe leaks.
   4. Gasketed Joints - Remove existing gasket and insert new gasket.
   5. Welded Steel Joints - Repair pipe in accordance with applicable ASME B31 code.
   6. Leaks in Material - Leaks located in pipe or fitting material require the replacement of that section of pipe or fitting and a repeat of the entire system using the complete procedure required for that system. Caulking, welding or epoxy is not permitted. Repair all damage caused by leaks.

G. Flushing - Complete pressure testing requirements prior to flushing. Performance of the flushing may be witnessed by the Architect/Engineer, Owner, or their representative, provide ample notification to all parties in advance of flushing any system. Perform system flushing in accordance with the following procedures:
   1. Flush all main and branch steam and liquid piping systems after pressure testing is complete with new potable water while draining the system at all low points. Isolate all connected equipment and flush individually.
   2. Flushing for piping and equipment will be considered complete when water samples taken at all low points indicate clear discharge-with no visible solids. If not clear, continue flushing and sampling until discharge is clear.

H. Cleaning - Complete flushing requirements prior to cleaning. Performance of the cleaning may be witnessed by the Architect/Engineer, Owner, or their representative, provide ample notification to all parties in advance of cleaning any system. Perform system cleaning in accordance with the following procedures:
   1. Clean all steam and condensate lines by blowing them out with live steam. Discharge steam and condensate from each main and branch safely to atmosphere for a minimum of five minutes.
   2. Clean all compressed air, instrument air, and fuel oil lines with oil-free dry compressed air at design pressure through each section so that they are blown free of dirt and debris.
   3. Clean domestic water lines by flushing with water until effluent is visibly as clean as the flushing medium.
   4. Clean hot water/chilled water lines as described below:
      a. When flushing discharge is clear, fill piping systems with water and sufficient approved alkaline cleaning material to remove dirt, oil and grease. Include all connected equipment in the cleaning.
      b. Vent system and place in operation, with automatic controls operating at set point temperature or an operating temperature designated by the Architect/Engineer. Circulate the solution through the system for a minimum of 4 consecutive hours.
      c. After 4 hours, drain system and flush with clean water until the pH at the farthest drain matches the clean water input. Keep strainers unplugged during the cleaning operations. Refill system with clean water.
   5. Clean temporary pump strainers and strainers at coils, etc. every 2 hours periodically during cleaning procedures. Do not remove temporary strainers until all cleaning steps are completed and the operation of the system indicates that the system is free of all foreign matter.
   6. Blow out all piping and equipment after cleaning and final flushing is completed and the system is drained with clean dry instrument air for a minimum of 15 minutes or until all water is expelled from the system. Upon completion seal the system by closing all drains and vents.
   7. Following the Architect/Engineers approval of the above flushing and cleaning procedures, immediately fill each system and chemically treat and monitor in accordance with the “Chemical Treatment Systems” specifications.

I. Pressure Testing Schedule:

Service	Test Type	Design Operating Pressure (psig)	Test Pressure (psig)
Fuel Oil Piping	Pneumatic		1.25 times maximum working pressure
Steam Piping	Hydrostatic		1.5 times maximum working pressure, but not less than 100 psi

Condensate Piping	Hydrostatic		1.5 times maximum working pressure, but not less than 100 psi
Natural Gas Piping	Pneumatic		1.5 times maximum working pressure but not less than 3 psig
Natural Gas Piping (In Schools)	Pneumatic		Working pressures up to 12" W.C. = 15 psig test pressure for 1 hour. Working pressures above 12" W.C. = 1.5 times the working pressure or a minimum of 50 psig for 1 hour.
Domestic Water Piping	Hydrostatic		1.5 times maximum working pressure, but not less than 100 psi
Condenser Water Supply & Return	Hydrostatic		1.5 times maximum working pressure, but not less than 100 psi
Heating Hot Water Supply & Return	Hydrostatic		1.5 times maximum working pressure, but not less than 100 psi

3.15 PAINTING

A. Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Paint in accordance with the requirements of the "Painting" Specification Section.

3.16 PIPE FREEZING

A. Where pipe freezing is required because of the lack of isolation valves, completely freeze piping using a jacket of liquid nitrogen. Provide the services of a company specializing in pipe freezing to perform the Work. Submit to the Architect/Engineer evidence that the company has performed this work for at least 5 years.

B. Approved Manufacturer's:
   1. Freeze Tech, Inc.
   2. Pro Tapping, Inc.

3.17 HOT TAPPING

A. Provide a hot tapping tool for cutting holes in piping under pressure without interrupting system operation and without release or loss of fluid.

B. Provide hot taps to permit new tie-ins to existing piping systems, insertion of flow meters, and permanent or temporary bypasses.

C. Hot tap rating, ½ through 48 inch line size: 1500 psig maximum operating pressure at 100 degrees F and 750 degrees F maximum operating temperature at 700 psig.

D. Provide the following information on the line to be tapped to the hot tap vendor before starting the Work:
   1. Line size, wall thickness, and pipe material.
   2. Fluid in line, and operating pressure and temperature.
   3. Dimensional information and restrictions, if any.
   4. Tap size and orientation (if other than 90 degrees perpendicular to run of the pipe, give full details).

E. Provide the services of a company specializing in hot taps to perform the Work. Submit to the Architect/Engineer evidence that the company has performed this work for at least 5 years.

F. Approved Manufacturer's:
   1. Topaz, Inc.
   2. Pro Tapping, Inc.

END OF SECTION 232000

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for piping systems.

B. Condensate Drain.

1.02 RELATED SECTIONS

A. Section 230529 - Pipe Hangers and Supports

B. Section 230555 - Mechanical System Identification

C. Section 230700 - Piping Insulation.

1.03 REFERENCES

A. Section 014500 - Quality Control: Requirements for references and standards.

B. ASTM D 1784 - Rigid Vinyl Compounds.

C. ASTM D 1785 - PVC Plastic Pipe, Schedule 40

D. ASTM D 2466 - PVC Plastic Fittings, Schedule 40

E. ASTM D 2665 - PVC Drain, Waste, and Vent Pipe and Fittings

F. ASTM D 2564 - Solvent Cements for PVC Pipe and Fittings

G. ASTM D 2321 - Underground Installation of Thermoplastic Pipe (non-pressure applications)

H. ASTM F 1668 - Procedures for Buried Plastic Pipe

I. ASTM F 1866 - Fabricated PVC DWV Fittings

J. NSF Standard 14 - Plastic Piping Components and Related Materials.

K. NSF Standard 61 - Drinking Water System Components - Health Effects.

1.04 SUBMITTALS FOR REVIEW

A. Section 013300 - Submittals: Procedures for submittals.

B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of New York and Town code.

B. Identify pipe with marking including size, ASTM material classification and ASTM specification.

1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with the State of New York and the Town code.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Section 016500 – Product Delivery, Storage, and Handling: Transport, handle, store, and protect products.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Section 014536 – Environmental Quality Control: Moisture control affecting products on site.

PART 2 - PRODUCTS

2.01 CONDENSATE DRAIN PIPING (DIAMETER LESS THAN OR EQUAL TO 1”)

A. Copper Type L Pipe and Fitting System.

B. Pipe and fittings shall be manufactured from Type L Copper.

C. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer.

D. Pipe and fittings shall conform to National Sanitation Foundation (NSF) Standard 61 or the health effects portion of NSF Standard 14.

E. Testing with or transport/storage of compressed air or gas in Copper pipe or fittings shall not be permitted.

F. The system is intended for pressure drainage applications where the temperature will not exceed 140°F.

2.02 CONDENSATE DRAIN PIPING (DIAMETER GREATER THAN 1”)

A. Type L copper solid wall pipe and type L copper fitting system.

B. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer.

C. Pipe and fittings shall conform to National Sanitation Foundation (NSF) Standard 14.

D. Testing with or transport/storage of compressed air or gas in copper pipe or fittings shall not be permitted.

E. The system is intended for non-pressure drainage applications where the temperature will not exceed 140°F.

2.03 PVC SCHEDULE 40 SOLID WALL PIPE AND PVC DWV FITTING SYSTEM.

A. Pipe and fittings shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds with a Cell Class of 12454 per ASTM D 1784.

B. PVC Schedule 40 pipe shall be iron pipe size (IPS) conforming to ASTM D 1785 and ASTM D 2665.

C. Injection molded PVC DWV fittings shall conform to ASTM D 2665. Fabricated PVC DWV fittings shall conform to ASTM F 1866.

D. Pipe and fittings shall be manufactured as a system and be the product of one manufacturer.

E. Pipe and fittings shall conform to National Sanitation Foundation (NSF) Standard 14.

F. Testing with or transport/storage of compressed air or gas in PVC pipe or fittings shall not be permitted.

G. Buried pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1668.

H. Solvent cement joints shall be made in a two step process with primer manufactured for thermoplastic piping systems and solvent cement conforming to ASTM D 2564.

I. Primer shall conform to ASTM F 656.

J. The system shall be protected from chemical agents, fire stopping materials, thread sealant, plasticized vinyl products, or other aggressive chemical agents not compatible with PVC compounds.

K. The system is intended for non-pressure drainage applications where the temperature will not exceed 140°F.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 013100 - Project Management and Coordination: Verification of existing conditions before starting work.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and the requirements of the Plumbing Code of New York State.

B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls. Effect changes in size with reducing fittings.

C. Install piping to maintain headroom, conserve space, and not interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to fittings. Refer to Section 230700.

F. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100 - Access Doors and Panels.

G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

H. Sleeve pipes passing through partitions, walls and floors.

I. Identify piping under provisions of Section 230555.

3.04 APPLICATION

A. Install unions downstream at equipment or apparatus connections.

3.05 ERECTION TOLERANCES

A. Section 014500 - Quality Control: Tolerances.

B. Establish invert elevations, slopes for drainage to ¼ inch per foot minimum. Maintain gradients.

3.06 FIELD QUALITY CONTROL

A. Drainage System: Test plug all system openings with the exception of the system's highest point. Fill system with water to the point of overflow and subject the highest point to 10-foot head of water. The system shall be considered tight if the pressure is held for not less than 30 minutes without signs of leakage.

END OF SECTION 232001

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the hydronic specialties for hydronic heating and cooling piping including, but not limited, to the following systems:
   1. Expansion Tanks
   2. Air and Dirt Separators
   3. Air Separators
   4. Triple Duty Valves
   5. Suction Diffusers
   6. Automatic Water Tempering/Mixing Valves
   7. Water Hammer Arrestors
   8. Thermostatic Radiator Valves

1.02 REFERENCES

A. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels.

1.03 SUBMITTALS

A. Product Data: Provide product data for manufactured products and assemblies required for the Work. Include component sizes, rough-in requirements, service sizes and finishes. Include product description, model and dimensions.

B. Submit manufacturer's instructions for maintenance and repair.

C. Provide a valve and specialty application schedule.

1.04 OPERATION AND MAINTENANCE DATA

A. Maintenance Data: Include installation instructions, assembly views, lubrication instructions and replacement parts list.

1.05 RELATED WORK

A. Section 232000 - Pipe, Valves and Fittings

1.06 QUALIFICATIONS

A. Companies specializing in making products specified with at least 5 years of experience and products that have been on the market for at least 3 years.

PART 2 - PRODUCTS

2.01 ASME PARTIAL BLADDER TYPE EXPANSION TANKS

A. Manufacturers:
   1. Taco, Inc; Model PAX (size and capacity as called for on plans)
   2. ITT Bell & Gossett
   3. Amtrol Inc
   4. Approved equal.

B. Construction: Welded steel, designed, tested and stamped in accordance with ASME (BPV code sec VIII, div 1); supplied with National Board Form U-1, rated for working pressure of 125

psi , with flexible seamless heavy duty butyl rubber bladder. (optional 150 psi) All wetted components to be fabricated of FDA approved materials. Bladder shall be able to accept the partial volume of the expansion tank and shall be removable and replaceable. The bladder shall be connected to the top of the tank via a hose/tube that with distribution holes that facilitate even expansion of the bladder.

C. System connection shall be via a ½ inch 304 stainless steel NPT connection on the top of the tank. A Schrader valve fitting shall be installed at the top of the tank to allow external pressurization of the bladder. Valve shall be protected by a 1½ “coupling welded to the tank.

D. Accessories: Pressure gage (field installed in adjacent piping by others) and air-charging fitting; precharge to pressure indicated on plans.

2.02 AIR AND DIRT SEPARATORS

A. Manufacturers:
   1. Taco, Inc; 4900 (size and capacity as called for on plans)
   2. Spirotherm.
   3. Flamco
   4. Approved equal.

B. Air and dirt removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125 psi at 270°F/. Manufacturer shall be holder of ASME U stamp. Optional 250 psi and 150 psi ASME units.

C. Units up to three 3-inch in size shall be provided with threaded connections as standard. Units four 4-inch and larger shall be provided with flanged system connections as standard. Inlet and outlet connections to be inline with piping system. Both inlet and outlet to be in the same horizontal and vertical planes.

D. Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill.

E. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator.

F. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 ½” and smaller the valve and all of its fittings shall be 1”. On units three 3” and larger the valve and all openings shall be 2”.

G. The air and dirt removal device shall remove air down to 18 microns and shall remove dirt/debris down to 35 microns. The unit shall be 100% efficient at removing dirt down to 90 microns in 100 passes or less.

H. The unit manufacturer shall provide the owner and design engineer third party independent test data certifying that their unit performs to the above standards. Suppliers not providing these independent performance test results will not be acceptable.

I. The air and dirt separator shall employ the use of high surface area pall rings to achieve optimal separation of air and dirt with minimal pressure drop. The pall rings shall be made of stainless steel. Stainless steel will be the only acceptable material used for suppressing turbulence and increasing surface area for high efficiency air and dirt removal. Inferior materials of construction such as copper for the straining medium will not be acceptable.

J. Manufacturer must have at least 15 years of experience with microbubble coalescing and dirt removal technology.

K. (OPTIONAL) The unit shall be manufactured with a removable cover to facilitate removal, inspection, and cleaning of the pall ring basket. The entire pall ring basket shall be constructed of stainless steel. For safety and ease of service the unit shall be accessed from the top and the pall ring basket shall be accessed as one complete assembly housed in a stainless steel cage.

2.03 AIR SEPARATORS

A. Manufacturers:
1. Taco, Inc; VorTech series (size and capacity as called for on plans)
2. Spirotherm.
3. Flamco
4. Approved equal.

B. Air removal device shall be designed for a maximum working pressure rating of 150 psi at 240 degrees F. Units up to 3-inch in size shall be provided with threaded system connections.

C. Construction:
1. Body and Cap: Cast Iron
2. Cartridge and Plate: Stainless Steel
3. O-Ring: Viton

D. The air removal device shall come standard with a replaceable high capacity air vent and an expansion tank connection tapping.

2.04 TRIPLE DUTY VALVES

A. Furnish and install as shown on Drawings, a valve designed to perform the functions of a center guided nonslam check valve, shutoff valve and calibrated balancing valve.

B. Heavy-duty cast iron construction.

C. 2” and smaller: NPT connections per ANSI B1.20.1-83 suitable for 175 psi working pressure for operating temperatures up to 250°F.

D. 2 ½” and larger: 125 psi ANSI flanged connections suitable for 175 psi working pressure connections for operating temperatures up to 250°F.

E. Fit valve with a bronze seat, replaceable bronze disc with EPDM seat insert, stainless steel stem, and chatter preventing stainless steel spring. Design to permit repacking under full system pressure.

F. Provide Cv rating at every 10% increment opening for read-out of flow determination and system pressure drop.

G. Equip with brass readout valves (with integral check valve) to facilitate taking differential pressure readings across the orifice for accurate system balance. Manufacture valve at an ISO 9001 approved facility.

H. Approved manufacturers: ITT Bell & Gossett

2.05 SUCTION DIFFUSERS

A. Furnish and install as shown on the Drawings, angle pattern flow straightening fitting equipped with a combination diffuser strainer-orifice cylinder, flow straightening vanes, start-up strainer and adjustable support foot. Design the combination diffuser-strainer-orifice cylinder to withstand pressure differential equal to the system pump shutoff head with a free area equal to five times the cross section area of the pump suction opening. Provide flow straightening vanes no less than 2 1/2 times the diameter of the system pump suction connection in length.

B. Cast Iron NPT and Flanged Models Rated for a Maximum Working Pressure of 175 PSIG.

C. 2” and smaller: Cast iron flow straightening fitting with NPT system and NPT pump connections.

D. 2 1/2” and larger: Cast iron flow straightening fitting with flanged system and flanged pump connections.

E. Stainless steel combination diffuser-strainer-orifice cylinder with 3/16" diameter perforations to protect the system pump. Full length stainless steel flow straightening vanes to provide nonturbulent flow to the suction side of the system pump. Bronze start-up strainer with 16 mesh. Construct so that all internal components are replaceable.

F. Approved manufacturer: ITT Bell & Gossett.

2.06 AUTOMATIC WATER TEMPERING/MIXING VALVES

A. Construct automatic hot water tempering valves completely of brass. Test valves to 300 pounds per square inch.

B. Equip the tempering valves with a long mixing chamber with vanes at an angle to the longitudinal axis of the valve to cause thorough mixing of hot and cold water.

C. Locate the thermostatic element inside the in the mixing chamber, in the main body of the tempering valve.

D. Provide the thermostatic element with a minimum length as per the following schedule:

SIZE	LENGTH
½” Tempering Valve	7-1/4 inches
¾” Tempering Valve	7-1/4 inches
1” Tempering Valve	11 inches
1-1/4” Tempering Valve	18 inches
1-1/2” Tempering Valve	23 inches
2” Tempering Valve	23 inches
2-1/2” Tempering Valve	27 inches
3” Tempering Valve	27 inches
4” Tempering Valve	27 inches

E. Construct the tempering valves to be adjustable to deliver water within close tolerances of any temperature between 120 degrees and 200 degrees Fahrenheit.

F. Approved manufacturers: Holby Valve Company, Inc.

2.07 WATER HAMMER ARRESTORS

A. ANSI A112.26.1; stainless steel shock absorber, piston type sized in accordance with PDI WH-201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi working pressure.

B. Install water hammer arrestor in the upright position as close as possible to the valve being served at locations shown on the Drawings and at all solenoid, remote operated or quick closing valves.

C. Approved Model: J. R. Smith 5000 series “Hydrotrol”.

2.08 THERMOSTATIC RADIATOR VALVES

A. Bellows design with either a liquid or vapor charge capable of temperature adjustment between 45 degrees and 86 degrees F. Select thermostatic radiator valves to maintain room temperature within +/- 1 degree F.

B. Accomplish locking or limiting of the temperature by the use of limiting pins or rings. The valve shall be of nickel plated brass construction with a fully replaceable packing gland replaceable while the system is in full operation due to a valve back seat gasket.

C. The packing gland shall be capable of replacement simply by using only a crescent wrench.

D. Construct the valve disc of EPDM capable of withstanding 250 degree F temperatures.

E. Connect the operator to the valve using a snap-on fast mounting system secured by an Allen screw.

F. Approved manufacturers: Danfoss

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer’s instructions and as shown on the Drawings.

B. Air separator and expansion tank to be installed on the suction side of the system pumps. Expansion tank to be tied into system piping in close proximity to air separator and system fill line.

C. Provide all necessary steel supporting members to support the expansion tank in an approved manner. Support vertical tanks with steel legs or base. Support horizontal tanks with steel saddles.

D. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

E. Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps where indicated.

F. Support pump fittings with floor mounted pipe and flange supports.

G. Provide radiator valves on water inlet to terminal heating units such as radiation, unit heaters, and fan coil units.

H. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.

I. Provide relief valves on expansion tanks.

J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

K. Pipe relief valve outlet to nearest floor drain.

END OF SECTION 232006

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Requirements of the following Division 23 Sections apply to this section:
   1. Section 230010 - General Mechanical Requirements.
   2. Section 230529 - Pipe Hangers And Supports
   3. Section 230555 - Mechanical System Identification
   4. Section 230700 - Pipe Insulation

1.02 SUMMARY

A. This Section includes refrigerant piping used for air conditioning applications. This Section includes:
   1. Piping, tubing, fittings, and specialties.
   2. Special duty valves.
   3. Refrigerants.

B. Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of or separately with packaged air conditioning equipment.

1.03 SUBMITTALS

A. Product data for the following products:
   1. Each type of valve specified.
   2. Each type of refrigerant piping specialty specified.

B. Shop Drawings showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximity to equipment.

C. Brazer's Certificates signed by Contractor certifying that brazers comply with requirements specified under "Quality Assurance" below.

D. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Division 01 and Division 23.

1.04 QUALITY ASSURANCE

A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".

B. Regulatory Requirements: Comply with provisions of the following codes:
   1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.
   2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.

C. Mechanical Code of New York State

1.05 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof piping supports, and roof penetrations.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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

B. Refrigerant Valves and Specialties:
1. Alco Controls Div, Emerson Electric
2. Danfoss Electronics, Inc
3. EATON Corporation, Control Div
4. Henry Valve Company
5. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division
6. Sporlan Valve Company

2.02 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3, Article "PIPE APPLICATIONS" for identification of systems where the below specified pipe and fitting materials are used.

B. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.

C. Copper Tubing: ASTM B 88, Type L, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing.

2.03 FITTINGS

A. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern for hard drawn and soft copper.

2.04 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver)

2.05 VALVES

A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.

B. Globe: 450 psig maximum operating pressure, 275 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.

C. Check Valves - Smaller Than 7/8 inch: 500 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast brass body, with removable piston, Teflon seat, and stainless steel spring; straight through globe design. Valve shall be straight through pattern, with solder-end connections.

D. Check Valves - 7/8 inch and Larger: 450 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass bolted bonnet; floating piston with mechanically retained Teflon seat disc. Valve shall be straight through or angle pattern, with solder-end connections.

E. Solenoid Valves: 250 deg. F temperature rating, 400 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2 inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.

F. Hot Gas Bypass Valve: adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; and wrought copper fittings for solder end connections.

2.06 REFRIGERANT PIPING SPECIALTIES

A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.

B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.

C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200 deg. F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.

D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets. Standard capacity desiccant sieves to provide micronic filtration.

E. Flanged Unions: 400 psig maximum working pressure, 330 deg. F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8 inch through 1-5/8 inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.

F. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

2.07 REFRIGERANT

A. Refrigerant No. 410A, in accordance with ASHRAE Standard 34.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.

3.02 PIPE APPLICATIONS

A. Use Type L, or Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Use Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted.

B. Install annealed temper tubing in pipe duct. Vent pipe duct to the outside.

C. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in Article "CLEANING" below.

3.03 PIPING INSTALLATIONS

A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."

B. Install piping in as short and direct arrangement as possible to minimize pressure drop.

C. Install piping for minimum number of joints using as few elbows and other fitting as possible.

D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

F. Insulate suction lines. Liquid line are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

G. Do not install insulation until system testing has been completed and all leaks have been eliminated.

H. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.

I. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

J. Slope refrigerant piping as follows:
   1. Install horizontal hot gas discharge piping with 1/2" per 10 feet downward slope away from the compressor.
   2. Install horizontal suction lines with 1/2 inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
   3. Liquid lines may be installed level.

K. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.

L. Use fittings for all changes in direction and all branch connections.

M. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

N. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

O. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

P. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

Q. Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves.

R. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.

S. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.

T. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

U. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

V. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.

W. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.

X. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

Y. Install flexible connectors at the inlet and discharge connection of compressors.

3.04 HANGERS AND SUPPORTS

A. General: Hanger, supports, and anchors are specified in Division 23 Section "PIPE HANGERS AND SUPPORTS." Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.

C. Support horizontal copper tubing in accordance with MSS SP-69 Tables 3 and 4, excerpts of which follow below:

NOMINAL PIPE SIZE (Inches)	ROD DIAMETER (Inches)	MAXIMUM SPACING (Feet)
1/2 to 3/4	3/8	5
1	3/8	6
1-1/4	3/8	6
1-1/2	3/8	8
2	3/8	8

D. Support vertical runs at each floor.

3.05 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."

B. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.

C. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do no apply heat near the bulb of the expansion valve.

D. Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.

E. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.06 VALVE INSTALLATIONS

A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.

B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.

C. Install a full sized, 3-valve bypass around each drier.

D. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.

E. Electrical wiring for solenoid valves is specified in Division 26. Coordinate electrical requirements and connections.

F. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.

G. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.

H. Install the valve in such a location so that the diaphragm case is warmer than the bulb.

I. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.

J. Where external equalizer lines are required make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.

K. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

3.07 EQUIPMENT CONNECTIONS

A. The Drawings indicate the general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow servicing and maintenance.

3.08 FIELD QUALITY CONTROL

A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

B. Repair leaking joints using new materials, and retest for leaks.

3.09 CLEANING

A. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:
   1. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.
   2. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
   3. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
   4. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.10 ADJUSTING AND CLEANING

A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Clean and inspect refrigerant piping systems in accordance with requirements of Division-23 General Mechanical Requirements

C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.11 COMMISSIONING

A. Charge system using the following procedure:
   1. Install core in filter dryer after leak test but before evacuation.
   2. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
   3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
   4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
   5. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
   6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.
   7. Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

B. Review data in Operating and Maintenance Manuals. Refer to Division 01 section "Project Closeout."

C. Schedule training with Owner with at least 7 days advance notice.

END OF SECTION 232300

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the galvanized steel, flexible, and aluminum ductwork for HVAC duct systems in accordance with SMACNA Duct Construction Standards, except as otherwise specified.

B. The construction material for each ductwork system shall be as listed in the “Ductwork Material Schedule” at the end of this Section.

C. This Section also describes the fittings, access doors, hangers and supports, manual volume dampers and sealants for each ductwork system as required.

1.02 RELATED WORK

A. Section 230594 - Balancing of Air Systems

1.03 REFERENCES

A. ASHRAE - Handbook Fundamentals; Latest Edition.

B. SMACNA - HVAC Duct Construction Standards Metal And Flexible (latest issue)

C. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

D. ASTM B 209 - Specifications for Aluminum and Aluminum-Alloy Sheet and Plate.

E. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

F. UL 555 S - Fire Dampers & Smoke Dampers.

G. NFPA 96 - Standard for Commercial Cooking Operations

H. New York State Mechanical Code.

1.04 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A and New York State Mechanical Code standards.

1.05 SUBMITTALS

A. Ductwork shop drawings for approval:
   1. Coordinate layout duct drawings that differ from ductwork shown on the Drawings.
   2. The review of deviations will be for pressure drop only. The review will not address clearances or accessibility to maintain or balance the air systems. No dimensional or coordination check of the shop drawings will be made. The Contractor has the sole responsibility to review the Drawings, coordinate ductwork fabrication, and provide clearances and access for installation, maintenance and balancing of this work, and work of other trades. Unless specifically dimensioned, Drawings indicate approximate locations only. The Contractor has the sole responsibility to locate and route the ductwork.
   3. Deviations such as changing direction or transforming or dividing ductwork must maintain ductwork cross-sectional area and not exceed transformation taper of 15 degrees.
   4. Plans and section showing all equipment and accessories.

5. Minimum 3/8 in. scale, double line, showing sizes, transverse joints, transitions, elevations, clearances and accessories; sections where required.

B. Shop details and catalog cuts of:
   1. Ductwork construction, including gauge and bracing schedule
   2. Supports
   3. Dampers
   4. Turning vanes
   5. Fire dampers
   6. Access doors
   7. Flexible connections
   8. Blank off panels
   9. Other accessories

1.06 QUALITY ASSURANCE

A. Construct all ductwork in accordance with referenced SMACNA Standards, except as otherwise stated. Ductwork pressure classifications shall be in accordance with referenced SMACNA Standards, except as otherwise specified.

B. For all uninsulated ductwork casings and plenums located outdoors, the reinforcement members shall be galvanized steel or stainless steel.

C. Construction pressure classification of ductwork are shown on the Drawings. If not shown, the pressure classification shall be greater than or equal to the maximum operating static pressure (minimum 2" w.c. pressure classification).

D. All ductwork shall be free from pulsation, chatter, vibration and objectionable noise. If any of these defects appear after a system is in operation, correct by removing and replacing, or reinforcing the ductwork, at no additional cost to the Owner.

E. For all galvanized steel ductwork, zinc coating shall be minimum G90 per ASTM A 653.

PART 2 - PRODUCTS

2.01 GALVANIZED STEEL RECTANGULAR DUCTS AND FITTINGS

A. Construct ducts of galvanized sheet steel meeting ASTM A 653 with G90 coating designation, and in accordance with the latest SMACNA HVAC Duct Construction Standards Metal And Flexible and pressure classifications as stated on the Drawings (minimum 2" w.c. pressure classification).

B. No ducts shall be less than No. 22 U.S. Gauge.

C. Piping, conduit and structure shall not penetrate ductwork. Where this condition cannot be avoided and with the written permission of the Architect/Engineer, follow SMACNA HVAC Duct Construction Standards Metal and Flexible, except that sides of transition sections shall slope a maximum of 15 degrees.

D. Provide 90-degree full-radius elbows with a centerline radius 1.5 times the duct width in the plane of the bend.

E. For elbows with centerline radius less than 1.5 times the width of the duct in the plane of the bend, provide turning vanes.

F. Provide square throat elbows with manufactured turning vanes.

G. All dissimilar metals shall be connected with flanged joints made up with fiber or neoprene gaskets to prevent contact between dissimilar metals. Flanges shall be fastened with bolts protected by ferrules and washers made of the same materials as the gaskets.

H. For split fittings, the split shall be proportional to the air flow. Construct per SMACNA HVAC Duct Construction Standards- Metal and Flexible.

I. Transitions and Offsets shall follow SMACNA HVAC Duct Construction Standards Metal and Flexible, except that sides of transitions shall slope a maximum of 15 degrees.

J. All branch take-offs perpendicular to the main shall be a 45 degree entry.

K. Longitudinal seams shall be of the Pittsburgh Lock type outlined in the SMACNA HVAC Duct Construction Standards Metal and Flexible.

L. Duct transverse joints shall be selected and used consistent with the static pressure class, applicable sealing requirements, materials involved, duct support intervals and other provisions for proper assembly of ductwork outlined in the SMACNA HVAC Duct Construction Standards - Metal and Flexible. Transverse joints T-25a, T-25b (Ductmate) shall only be used. Metal clips will only be allowed (NO PVC). Ductmate shall not be used for the following (use transverse joints T-15 through T-24 in these cases):
   1. The Ductmate '45' system shall not be used for applications with duct gauges heavier than 10 or lighter than 22.
   2. The Ductmate '35' system shall not be used for applications with duct gauges heavier than 16 GA. or lighter than 26 GA.
   3. The Ductmate '25' system shall not be used for application with duct gauges heavier than 20 GA. or lighter than 26 GA.

2.02 TURNING VANES

A. Manufactured with same material as ductwork that it is installed in and to the same pressure classification as ductwork that they are installed in.

B. Provide turning vanes in all square duct elbows and as noted on the Drawings.

C. Vanes shall be single thickness Small Vane as detailed in SMACNA HVAC Duct Construction Standards Metal and Flexible.

D. Where a rectangular duct changes in size at a square-throat elbow fitting, use single thickness turning vanes with trailing edge extensions aligned with the sides of the duct.

2.03 ACCESS DOORS

A. For access doors for use in ductwork receiving Fire Rated Blanket Insulation see Ductwork Insulation Section for requirements. Fabricate all other access doors in accordance with SMACNA Duct Construction Standards Metal And Flexible and as indicated.

B. For HVAC duct systems, construct doors of the same material as the ductwork. Minimum size of access doors shall be 8 inches by 8 inches, unless shown otherwise.

C. Provide walkthrough doors where shown. These doors shall have a minimum clear width of 18 inches. Provide doors with 8 inch square double pane wire glass windows. Locate windows not to exceed 5 feet-6 inches to centerline above finished floor of installed casing. Walk-through doors shall be operable from both sides of the door.

D. Access doors shall be insulated same as duct.

E. Provide with continuous neoprene gaskets around perimeter of access doors for airtight seal.

F. Provide all access doors with cam lock latches.

G. Provide access doors with watertight gaskets in shower room exhaust ductwork. Doors shall be of extra-heavy stainless construction.

H. All access doors serving a fire damper shall be painted red and shall have a label with white letters not less than ½ inch high reading “FIRE DAMPER”. No external ductwork insulation shall conceal a fire damper access door unless there is a label attached to the insulation indicating the exact location of the access door.

I. Provide access doors in following locations:
   1. Heaters and coils in ducts: entering and leaving side.
   2. Automatic dampers: linkage side.
   3. Fire damper, on both sides of ducts.
   4. Smoke detection heads.
   5. On both sides of ducts where necessary to provide maintenance accessibility to equipment on either side.
   6. VAV boxes
   7. Heating and Cooling coils.
   8. Fan Plenums.
   9. In-Line Fans (suction and discharge sides)
   10. Other items requiring access for service/maintenance

J. Where duct access doors are concealed the Contractor shall furnish and pay for installation of access doors to be mounted in the fire rated walls and ductwork enclosures. The access doors must be fire resistive and minimum 6” larger on each side then the duct access door for the above mentioned applications.

2.04 MANUAL VOLUME DAMPER

A. Fabricate in accordance with SMACNA Duct Construction Standards Metal And Flexible, and as indicated.

B. Fabricate single blade dampers for duct sizes up to 6 inches in height.

C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes of 4 inches for ducts above 6 inches in height. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

E. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches, provide regulator at both ends.

F. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

G. Volume damper shall be provided at each duct branch and also where shown on the Drawings. Volume dampers must be installed at each branch even if they are not shown on the Drawing.

H. Approved Manufacturers:
   1. Ruskin Mfr. Co.
   2. Arrow Damper & Louver.
   3. Imperial Damper Co.

2.05 BACKDRAFT DAMPERS

A. Dampers shall be low-leakage, parallel-blade type. Damper sizes shall be suitable for duct sizes noted on the Drawings. The dampers shall be suitable for a minimum 4000 fpm velocity.

B. Damper frames shall be minimum No. 12 gauge galvanized steel blades shall be minimum No. 16 gauge galvanized steel or Type 6063-T5 aluminum with press-fit ball bearings.

C. Dampers shall be complete with adjustable counterweights and linkage for duty at .20 inches w.g. and 3500 fpm.

D. Provide neoprene or silicone rubber blade seals.

E. Approved manufacturers - Ruskin Manufacturing Company.

2.06 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 DUCT HANGERS AND SUPPORTS

A. Provide trapeze, strap or angle iron hangers meeting SMACNA HVAC Duct Construction Standards Metal and Flexible.

B. Materials of hangers, supports and fasteners shall conform to the manufacturer’s load ratings.

C. Hangers, supports, upper attachments and inserts shall be hot-dip galvanized steel or stainless steel.

D. Fasteners for HVAC duct systems shall be hot-dip galvanized steel, cadmium-plated steel or stainless steel.

E. Secure ductwork hangers attached to concrete structures and slabs with embedded inserts, anchor bolts or concrete fasteners. A safety factor of 5 should be used in selection of all inserts and expansion bolts (if applicable safety factor shall be determined by analysis of seismic loads and the greater safety factor shall be used).

F. Provide hangers and supports not more than 12 inches from each face of a horizontal elbow.

G. Plenums shall be supported to permit personnel to enter the plenum. If no structural steel design is shown on the Drawings, it is the responsibility of the Contractor to provide the services of a licensed structural engineer in the in which the project is to be constructed to submit a structural design for review.

2.08 SEALANTS

A. Where ducts are not continuously welded or soldered, provide sealants and gaskets as required to meet the specified duct leakage allowance.

B. Provide Gaskets, Sealers, Mastics and Tapes as manufactured by Ductmate.

2.09 FIRE DAMPERS

A. Fabricate and install in accordance with NFPA 90A and UL Safety Standard 555, and AMCA Standard 500.

B. Fire Resistance: For penetrations through construction rated less than 3 hours, 1 ½ hours. For penetrations through construction rated for 3 hours or more, 3 hours.

C. Pressure Differential Rating: 4 in. w. g.

D. Velocity Rating: 2000 fpm

E. Fabricate curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades in air stream. Fabricate fire dampers for vertical and horizontal position.

F. Fabricate multiple blade fire dampers with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible links, UL 33, shall separate at 165 degrees F.

H. Acceptable Manufacturers:
   1. Greenheck Model DFD 150, 200 and 350
   2. Ruskin Mfr. Co.
   3. Arrow Damper & Louver.
   4. Imperial Damper Co.

2.10 SMOKE DAMPERS

A. Fabricate and install in accordance with NFPA 90A and UL Safety Standard 555S, and AMCA Standard 500.

B. Leakage Class: Leakage Class II per UL 555S

C. Pressure Differential Rating: 4 In. w. g.

D. Air Flow Velocity: 2000 fpm

E. Elevated Temperature Rating: 350 Deg. F per UL555S

F. Fabricate smoke dampers with 16 gage galvanized steel frame and blades, sintered bronze sleeve type bearings rotating in polished extruded holes in the damper frame, 1/2 inch dia. (minimum) plated steel axles, linkage concealed in the jamb, stainless steel blade stops, silicone rubber blade edge seals, and stainless steel compression type jamb seals.

G. Actuators: 24 VDC, 2-position, external mounting

H. Acceptable Manufacturers:
   1. Greenheck Model SMD-200 and SMD-300.
   2. Ruskin Mfr. Co.
   3. Arrow Damper & Louver.
   4. Imperial Damper Co.

2.11 COMBINATION FIRE SMOKE DAMPERS

A. Fabricate and install in accordance with NFPA 90A and UL Safety Standards 555 & 555S, and AMCA Standard 500.

B. Fire Resistance: For penetrations through construction rated less than 3 hours, 1 ½ hours. For penetrations through construction rated for 3 hours or more, 3 hours.

C. Leakage Class: Leakage Class II per UL 555S

D. Fusible links, UL 33, shall separate at 165 degrees F.

OR

E. Resettable links shall be provided in lieu of a fusible link. Resettable link shall interrupt power to the actuator causing the actuator's spring return mechanism to cause the damper to close at 165 degrees F. Resettable link to be provided with an electric sensor (thermostat). Sensor to be of the manual reset type and shall be capable of being reset after the temperature has cooled down below the sensor set point.

F. Pressure Differential Rating: 4 In. w. g.

G. Air Flow Velocity: 2000 fpm

H. Elevated Temperature Rating: 350 Deg. F per UL555S

I. Fabricate multiple blade fire dampers with 16 gage galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

J. Actuators: 24 VDC, 2-position, external mounting

K. Acceptable Manufacturers:
   1. Greenheck Model FSD-200
   2. Ruskin Mfr. Co.
   3. Arrow Damper & Louver.
   4. Imperial Damper Co.

2.12 KITCHEN EXHAUST DUCTWORK (PRE-FABRICATED)

A. Furnish single-wall, factory built, grease duct for use with Type I kitchen hoods, which conforms to the requirements of NFPA-96. Products shall be ETL listed to UL-1978 and CAN/ULC-S662 for venting air and grease vapors from commercial cooking operations as described in NFPA-96.

B. The duct wall shall be constructed of .036 and .047 thick stainless steel and be available in diameters 8" through 24".

C. All supports, fan adapters, hood connections, fittings and expansion joints required to install grease duct shall be included.

D. Roof penetrations shall comply with listed clearance to combustibles. The grease duct will terminate at the fan adapter plate, will be fully welded to the fan adapter plate and the fan adapter plate will be fastened to the curb using a suitably sized fastener provided by others. See manufacturers installation instructions for more details.

E. Grease duct joints shall be held together by means of formed vee clamps and sealed with 3M Fire Barrier 2000+. Screws used to secure the vee clamps shall be of the hex-head type with flanged stops and tapered "lead in" threads for easy starting. Nuts shall be retained by means of a free-floating cage to allow easy alignment.

F. Single-Wall Grease Duct shall be installed in accordance with the manufacturer's "Installation, Operation and Maintenance Manual", ETL listing and state and local codes.

G. Grease duct installed outside of the building shall be protected against accidental damage or vandalism.

H. Support vertically installed grease duct from the building structure using rigid structural supports. Anchor supports to the structure by welding or bolting steel expansion anchors or concrete inserts. Support horizontally installed grease duct from the building structure using above method. 1/2" Threaded rod and saddles may also be used for the support of horizontal grease duct.

I. Fans shall be supported independently from the grease duct sections. Protect grease duct from twisting or movement caused by fan torque or vibration.

J. Duct shall slope not less than one-fourth unit vertical in 12 units horizontal toward a grease reservoir. If a grease reservoir is not provided, slope shall be towards the hood.

2.13 KITCHEN EXHAUST DUCTWORK (BLACK IRON)

A. All longitudinal seams shall be continuously welded. Transverse joints made in the shop shall also be made with a continuous weld. Kitchen range exhaust ducts shall be constructed of and supported as follows:
   1. Ducts with a cross-sectional area up to and including 155 square inches shall be No. 16 gauge black iron.
   2. Ducts with a cross-sectional area over 155 square inches but less than 200 square inches shall be No. 14 gauge black iron.
   3. Ducts with a cross-sectional area equal to or greater than 200 square inches shall be No. 12 gauge black iron.

B. Ducts shall be installed without forming dips or traps.

C. Overlapping duct connections of either the telescoping or the bell type shall be used for welded field joints, not butt-weld connections. The inside duct section shall always be uphill of the outside duct section. The difference between inside dimensions of overlapping sections shall not exceed ¼ in. The overlap shall not exceed 2 in.

D. For cleanout access doors requirements see the Ductwork Insulation Section.

E. All elbows shall be radius type with centerline radius to 1-1/4 times the duct width.

F. Locate the ductwork with the minimum clearances to combustible material required by NFPA 96 Chapter 4, Duct systems.

G. Exhaust fans with ductwork connected to both sides shall have access doors for cleaning and inspection within 3 ft of each side of the fan.

H. Openings shall be provided at the sides or at the top of the duct, whichever is more accessible, and at changes of direction.

I. On horizontal ducts at least one 20 in. by 20 in. opening shall be provided for personnel entry. Horizontal ducting shall be secured sufficiently to allow for the weight of personnel entry into the duct. Where an opening of this size is not possible, openings large enough to permit thorough cleaning shall be provided at 12-ft intervals.

J. Duct shall slope not less than one-fourth unit vertical in 12 units horizontal toward a grease reservoir. If a grease reservoir is not provided, slope shall be towards the hood.

2.14 STAINLESS STEEL DUCTWORK

A. Fabricate ducts serving dishwasher hoods of minimum 20 gage AISI Type 302 or 304 stainless steel sheet metal.

B. Fabricate ducts serving laboratory exhaust fume hoods of minimum 20 gage AISI Type 316 stainless steel sheet metal.

C. Use stainless steel with a No. 4 finish where installed exposed in finished rooms and No. 2B finish in other locations. Use stainless steel fasteners for ductwork installed exposed in finished rooms and where fastener penetrates duct. Galvanized fasteners may be used in unfinished spaces for non-penetrating service.

D. Use stainless steel reinforcing members for ducts in finished spaces and galvanized steel in unfinished spaces.

E. Longitudinal Seams For Dishwashing, and Other Scullery Equipment Exhaust Ducts: Form double corner seams, or Pittsburgh lock seams.
   1. Fabricate elbows and transitions with Pittsburgh lock seams.
   2. Fabricate double compounded elbows and other complex fittings with double corner seams.
   3. Locate seams in horizontal ducts at top corners of ducts, unless otherwise approved in writing.
   4. Locate seams in vertical ducts at rear corners of ducts.

F. Construct ductwork as per “GALVANIZED STEEL RECTANGULAR DUCTS AND FITTINGS” section above unless otherwise noted in this section.

G. At dishwasher locations, pitch horizontal ductwork minimum ¼ inch per foot such that low point is at the dishwasher.

2.15 ALUMINUM DUCTWORK

A. Construct ducts of minimum No. 20 gauge aluminum sheet meeting ASTM B 209, Series 3000 Alloy.

B. Construct ductwork as per “GALVANIZED STEEL RECTANGULAR DUCTS AND FITTINGS” section above unless otherwise noted in this section.

C. At shower room locations, pitch horizontal ductwork minimum ¼ inch per foot such that low point is at shower room.

2.16 CLOTHES DRYER EXHAUST DUCTWORK

A. Construct ducts of rigid metal and shall have a smooth interior finish.

B. Exhaust system shall be independent of all other systems.

C. Fire dampers, combination fire/smoke dampers, and any similar device that will obstruct the exhaust flow, shall be prohibited in clothes dryer exhaust ducts.

D. Each vertical riser shall be provided with a means for cleanout.

E. Terminations at building exterior shall be provided with a backdraft damper. Screens shall not be installed at the duct termination.

F. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow. The male end of the duct at overlapped duct joints shall extend in the direction of airflow.

G. Clothes dryer transition ducts used to connect the appliance to the exhaust duct system shall be limited to single lengths not to exceed 8 feet and shall be listed and labeled for the application. Transition ducts shall not be concealed within construction.

H. Clothes dryer exhaust ducts shall not be connected to a vent connector, vent, or chimney.

I. Clothes dryer exhaust ducts shall not extend into or through ducts or plenums.

J. Install in accordance with the manufacturer’s instructions and the Mechanical Code of New York State.

2.17 STANDARD FLEXIBLE CONNECTIONS

A. Provide fabric flexible duct connections.

B. Fabric shall be UL approved, fire-retardant, closely-woven glass, double coated with neoprene, and a minimum of 4 inches wide.

C. Shall be installed at duct connections to all ceiling hung fans and where vibration will be transmitted through ductwork.

D. Approved Manufacturers:
1. “Ventglas” by Vent Fabrics, Inc.

2.18 HEAVY DUTY FLEXIBLE CONNECTIONS

A. Heavy Duty Flexible Connections shall be used in high pressure (greater than 2 in. w.c.), high temperature (greater than 150 degree F) air applications or where the gas is highly corrosive and the duct connector must be leak proof.

B. Flexible Connectors shall be flanged. If installed outdoors, all metallic components shall be stainless steel construction. Provide flexible connector materials of construction as recommended by the manufacturer for the pressure, temperature, and gas that is being used in air handler system.

C. Approved Manufacturers:
   1. Mercer Rubber Company

2.19 FLEXIBLE DUCTS

A. Comply with SMACNA HVAC Flexible Duct Construction Standards and NFPA 90A.

B. Provide where indicated on the Drawings Flexmaster Type TL- M Flexible Metal UL181 Class I Air Duct.

C. The duct shall be constructed of .005" thick 3003-H14 aluminum alloy in accordance with ASTM B209.

D. The duct shall be spiral wound into a tube and spiral corrugated to provide strength and flexibility.

E. The internal working pressure rating shall be at least 10" w.g. positive and 10" w.g. negative with a bursting pressure of at least 2½ time the working pressure.

F. The duct shall be rated for a velocity of at least 5500 feet per minute.

G. The duct must be suitable for continuous operation at a temperature range of -40° F to +250° F.

H. Factory insulate the flexible duct with fiberglass insulation. The R value shall be at least 4.2 at a mean temperature of 75° F.

I. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E96, Procedure A.

J. Install flexible metal duct as per SMACNA HVAC Duct Construction Standards Metal and Flexible (Latest Edition).

K. Flexible ductwork shall only be installed where shown on the Drawings.

L. Provide flexible duct supports at all elbows and changes in direction that maybe subject to restriction, collapsing, or pinching to mitigate chance of reduction in cross section area, flow velocities and noise. Duct support shall be minimum radius = duct diameter, nylon polymer constuction, with nylon straps. Malco FDS1 or equal.

2.20 GALVANIZED STEEL ROUND DUCTS AND FITTINGS

A. Construct ducts of galvanized sheet steel meeting ASTM A 653 with G90 coating designation, and in accordance with the latest SMACNA HVAC Duct Construction Standards Metal and Flexible (Latest Edition).and pressure classifications as stated on the Drawings (minimum 2" w.c. pressure classification). When the ductwork pressure classification of these standards is exceeded, construct galvanized steel round exhaust ductwork in accordance with SMACNA Round Industrial Duct Construction Standards.

B. For ductwork through 60 inches in diameter, provide ducts of spiral lock-seam construction.

C. For ductwork over 60 inches in diameter, provide ducts of welded longitudinal seam construction.

D. For ductwork through 36 inches in diameter, use beaded sleeve transverse joints.

E. For ductwork over 36 inches in diameter, use gasketed-flanged Van Stone transverse joints. Gasket shall be “440 Gasket Tape” by Ductmate Industries, Inc.

F. For ductwork under a positive pressure through 96 in. diameter and 10 in. w. g. no reinforcing is required. For ductwork under a negative pressure in exposed areas use duct gauge that will minimize the use of reinforcing as appropriate for the pressures involved.

G. Draw band joints will not be permitted.

H. All elbows shall be constructed with a centerline radius equal to 1.5 times the duct diameter.

I. Provide matching galvanized steel fittings with continuously welded seams and joints.

J. All take-off connections to duct headers shall be made using tee (90 degrees), lateral (45 degrees), tee cross, lateral cross and “Y” branch fittings of the conical type. All fittings fabricated as separate fittings shall have continuous welds along all seams and joints.

K. The use of two-piece mitered, vaned elbows will be permitted only with specific written approval from the Architect/Engineer. Provide turning vanes as per SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.21 LOUVER BLANK OFF PANELS

A. Facing: 0.032 inch thick aluminum on both sides

B. Perimeter Frame: 0.050 inch thick-formed aluminum channels

C. Core: Expanded polystyrene (EPS), R value of 8

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Install ductwork in accordance with applicable SMACNA Duct Construction Standards Metal And Flexible and approved submittals, and as shown on the Drawings. Duct sizes shown are inside clear dimensions. Where internal duct liners are used, duct sizes shown are inside clear of liner. For ductwork located outside, provide reinforcing sufficient to support wind and snow loads.

B. The Drawings indicate general locations of ducts. Make additional offsets or changes in direction as required at no additional cost to the Owner.

C. Wherever ductwork is divided, maintain the cross-sectional area.

D. Do not exceed 15-degree taper when constructing duct transitions.

E. Close the open ends of ducts during construction to prevent debris and dirt from entering.

F. Secure casings and plenums to curbs according to the requirements of the SMACNA HVAC Duct Construction Standards Metal and Flexible.

G. Make changes in direction with long radius bends.

H. All unused portions of HVAC supply air and exhaust louvers shall be blanked off with Louver Blank Off Panels, see Ductwork Insulation Section.

I. All welded and scratched galvanized steel surfaces shall be touched up with zinc-rich paint.

J. 2 Hr. rated wall penetration: Where small size duct (up to 6 inches x 6 inches) is penetrating a 2 Hr wall the duct shall be constructed of 16 gauge galvanized sheet metal.

K. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

L. Patch and repair all wall penetrations.

M. Insulation: Where Drawings and Specifications indicate that ducts are to be insulated make provisions for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. Metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished to be mounted on duct.

3.02 FITTING INSTALLATION

A. Use minimum of four sheet metal screws per joint.

B. Apply approved sealant on duct-to-duct joint before assembly. Apply additional sealant after assembly to make joint airtight.

3.03 HANGER AND SUPPORT INSTALLATION

A. Support ductwork hung from building structure using trapeze, strap or angle iron hangers conforming to SMACNA HVAC Duct Construction Standards Metal and Flexible. Provide supplemental structural steel to span joists where required.

B. Do not support ductwork from furring, hung ceilings, metal floor deck, metal roof deck or from another duct or pipe.

C. Do not hang lighting fixtures or piping from ductwork.

D. Do not use perforated band iron.

E. Support ductwork at each change in direction.

F. Where duct connects to or terminates at masonry openings or at floors where concrete curbs are not used, provide a continuous 1 ½ inch by 1 ½ inch by 3/16 inch galvanized steel angle support around the ductwork. Bolt and seal the supports to the building construction using expansion bolts and caulking compound. Seal shall be watertight at floor or wall and duct such that a spill will no pass down through the opening.

G. Fasten plenums and casings connected to concrete curbs using continuous 1 ½ inch by 1 ½ inch by ¼ inch galvanized steel angle support. Set the angle support in a continuous bead of caulking compound and anchor it to the curb with 3/8 inch diameter anchors on 16 inch centers. Terminate sheet metal at curb and bolt to angle support. Seal sheet metal to curb with a continuous bead of caulking.

H. For insulated ductwork, install hangers on the outside of the insulation. To maintain the insulation value, inset a piece of 1 inch thick, 6 pcf fiberglass board with a foil/scrim/kraft (FSK) jacket at these supports.

3.04 SEALING

A. Where ductwork is not continuously welded, soldered or gasketed, make seams and joints airtight with sealants.

B. Install the sealants in accordance with the sealant manufacturer's instructions and recommendations.

C. Seal all ductwork seams, joints, fastener penetrations and fittings connections with sealants in accordance with SMACNA Seal Classifications as required by SMACNA Duct Pressure Classification. All ductwork, regardless of pressure classification, shall have a minimum Seal Class B.

D. Completely fill all voids when liquid sealing ductwork. Several applications may be necessary to fill voids caused by shrinkage or runout of sealant.

3.05 DUCT-MOUNTED DEVICES AND ACCESS DOORS

A. Install all dampers, coils, airflow measuring stations, humidifiers and other duct-mounted devices, specified in other sections of the specifications or as shown and provide transformations to dimensions as required. Install devices in accordance with manufacturer's recommendations. Install dampers and coils a minimum of 4 feet away from changes indirection or transitions. Allow five (5) equivalent diameters of straight ductwork upstream and one (1) equivalent diameter of straight ductwork downstream of airflow measuring devices.

B. Install access doors in ductwork, plenums and where specified and as shown. Provide access doors for inspection and cleaning automatic dampers, at fire dampers, and elsewhere as indicated. Provide minimum 18 x 18 inch size for shoulder access and as indicated. Install access doors in the bottom of the ductwork unless they are inaccessible in this location; then install the access doors in either the side or top of the ductwork, whichever is more accessible.

C. Provide fire damper at locations indicated, and where outlets pass through fire rated components and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway, duct connections, corrosion resistant springs, bearings, bushings and hinges.

D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Engineer.

E. Provide flexible connections immediately adjacent to equipment in ducts associated with motorized equipment. Cover connections to medium pressure fans with leaded vinyl sheet, held in place with metal straps.

F. Pilot Ports: Locate pilot ports for measuring airflow in each main supply duct at the downstream end of the straightest run of the main and before the first branch take-off. Form pilot ports by drilling 7/16 inches holes in the duct, lined up perpendicular to airflow on maximum 8-inch centers and at least three to a duct, evenly spaced. Holes to be plugged with plastic plugs. Provide access to these for future rebalancing.

3.06 CONTROL DAMPER INSTALLATION

A. Duct openings shall be free of any obstruction or irregularities that might interfere with blade or linkage rotation or actuator mounting. Duct openings shall measure 1/4" larger than damper dimensions and shall be square, straight, and level.

B. Individual damper sections, as well as entire multiple section assemblies, must be completely square and free from racking, twisting, or bending. Measure diagonally from upper corners to opposite lower corners of each damper section. Both dimensions must be equal ±1/8".

C. Follow manufacturer's instructions for field installation of control dampers. Unless specifically designed for vertical blade application, dampers must be mounted with blade axis horizontal.

D. Install extended shaft or jackshaft per manufacturer's instructions. (Typically, a sticker on the damper face shows recommended extended shaft location. Attach shaft on labeled side of damper to that blade.)

E. Damper blades, axles, and linkage must operate without binding. Before system operation, cycle damper after installation to assure proper operation. On multiple section assemblies, all sections must open and close simultaneously.

F. Provide a visible and accessible indication of damper position on the drive shaft end.

G. Support ductwork in area of damper when required to prevent sagging due to damper weight.

H. After installation of low-leakage dampers with seals, caulk between frame and duct or opening to prevent leakage around perimeter of damper.

I. Dampers that are to be installed with air flow measuring stations shall be installed in duct runs with a minimum amount of straight duct upstream and downstream of the damper to allow accurate flow readings by the air flow measuring station. The Contractor shall verify with the manufacturer the length of straight duct runs required.

3.07 SMOKE DAMPER INSTALLATION

A. Install dampers in accordance with manufacturer’s UL Installation Instructions, labeling, and NFPA 90A at locations indicated on the Drawings.

B. Dampers shall be accessible to allow inspection, adjustment, and replacement of components. Access doors in ductwork, plenums, walls, ceilings, or other general building construction shall be provided. Coordinate with other trades.

C. Where a damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.

D. Where a damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.

E. Where a damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet horizontally of the damper.

F. Where a damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.

G. Where a total-coverage smoke detector system is provided within areas served by an HVAC system, dampers shall be permitted to be controlled by the smoke detection system.

3.08 DUCTWORK AND EQUIPMENT LEAK TESTING

A. Leak test each ductwork system within ten working days of ductwork installation and before ductwork is insulated and concealed.

B. All HVAC ductwork shall be tested. Follow general procedures and use apparatus as outlined in the SMACNA HVAC Air Duct Leakage Test Manual.

C. Test all ductwork at 100 percent of the pressure classifications indicated.

D. Air testing during erection shall include separate leakage air tests of air riser, horizontal distribution system, and, after all ductwork is installed and the central stations apparatus is erected, leakage testing of the whole system.

E. Use Appendix C in the SMACNA HVAC Air Duct Leakage Test Manual to determine allowable leakage rates for each duct section tested.

F. All devices, including access doors, airflow measuring devices, sound attenuators, damper casings, sensors, test ports, etc. that are furnished and/or installed in duct systems shall be included as part of the duct system leakage allowance. All joints shall be inspected and checked for audible leakage, repaired, if necessary, and retested. Duct leakage shall be limited to the following:

Average Size of Run Diameter or Equivalent	***A/100 ft. Run**
12 inches or less	10
20 inches or less	15
30 inches or less	25
40 inches or less	30
50 inches or less	30
* (A) = Permissible loss in cfm	

G. Total system leakage shall not exceed 10 percent of the scheduled design capacity of the system when tested as per SMACNA testing methods.

3.09 DUCTWORK AND EQUIPMENT LEAK TESTING - GREASE EXHAUST AND WATER LEAK PROOF DUCTWORK

A. Prior to use, covering or concealment of any ductwork perform a leakage test in the presence of the Owner and Authority Having Jurisdiction.

B. Perform a light test or other approved test to determine that all welded or brazed joints are liquid tight.

C. Light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of duct to be tested.
   1. The lamp shall be open so as to emit light in all directions.

D. Repair any visible light leakage.

3.10 PAINTING

A. Upon completion of the installation, remove all protecting materials, thoroughly remove all scale and grease and leave in a clean condition for painting. Ductwork to be painted shall be as shown on the Drawings. Painting shall be in accordance with the requirements of the “Painting” Specification Section.

3.11 DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	DUCTWORK MATERIAL
Supply, Outside Air & Exhaust Ductwork	Galvanized Steel
Kitchen Exhaust	Black Iron
Shower Room Exhaust	Aluminum
Ductwork Exposed to Weather	Aluminum
Dishwasher Hood Exhaust	Type 302 or 304 Stainless Steel
Laboratory Exhaust Fume Hood	Type 316 Stainless Steel
Clothes Dryer Exhaust	Rigid Metal

END OF SECTION 233113

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide exhaust fans, as specified herein, with accessories and of sizes and capacities as noted here-in, and as scheduled and in locations shown on drawings.

B. Products listed in Part 2 of this Section include:
   1. Centrifugal Up / Down Blast Fans
   2. Dryer Exhaust Fans
   3. Centrifugal In Line Fans
   4. Utility Set Fans
   5. Ceiling Exhaust Fans
   6. High Plume Dilution Fans

1.02 ACCESSORIES:

A. Provide accessories as scheduled. Refer to controls diagrams and specifications, sequence of operations specifications and electrical drawings for detailed requirements.
   1. Back draft dampers
   2. Motorized dampers with appropriately sized actuators
   3. Motor speed controls, interlock and control and monitoring devices
   4. Disconnect switches
   5. Roof curbs
   6. Curb Adapters
   7. Wind or Seismic restrains, guy wires, etc.

1.03 RELATED WORK

A. Section 061000: Rough Carpentry

B. Section 076200: Flashing and Sheet Metal

C. Section 079200: Joint Sealants

D. Section 230010: General Mechanical Requirements

E. Section 230594: Balancing of Air Systems

F. Section 230991: Instrumentation and Controls Integration

G. Section 230993: Sequence of Operations

1.04 REFERENCE CODES AND STANDARDS

A. AMCA 99 - Standards Handbook

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating

C. AMCA 260 - Performance of Induced Flow for High Plume Dilution Fans

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans

E. ASHRAE Handbook, HVAC Applications Volume “Sound and Vibration Control”

F. UL listed and labeled.

1.05 SUBMITTALS

A. Shop Drawings - Show fan layout, housing, materials, gauges, dimensions, weights and installation details

B. Product data - Manufacturer's fan performance (data includes cfm, rpm, bhp, motor nameplate data, tip speed, outlet velocity and static pressure) and sound performance (data includes sound power level ratings by octave bands) as tested in accordance with AMCA Standards 210 and 300.

C. Fan performance curves - Submit curves for all fans with system performance shown, and for plus or minus 10 percent and plus or minus 20 percent change in fan rpm. Curves shall include plotted rpm, horsepower, cfm, static pressure, and fan surge line and operating point.

D. Certified AMCA Ratings - Submit ratings for air and sound performance.

E. UL Listing - Submit listing if specified.

1.06 QUALITY ASSURANCE

A. Factory balance each fan statically and dynamically, test run before shipment, and key fan wheel to fan shaft. Fans shall operate quietly and without pulsation or vibration. Conduct sound power level tests for each type fan at the factory in accordance with AMCA 300.

B. Fans shall operate in the stable range of their performance curves.

C. The fan external static pressures shown in the schedules are those required by the ductwork and apparatus, and do not include the internal and intake fan losses, inlet vanes or integral outlet dampers, inlet screens, outlet velocity heads or drive losses.

D. Factory performance test each fan assembled in or as part of apparatus specified to be performance tested. Test shall display scheduled performance characteristics, using certified, calibrated testing instruments provided by the manufacturer of the apparatus.

E. All fan performance ratings shall be based up on factory tests performed in accordance with AMCA 210 and 300. One fan of each type specified shall have actual factory performance tests performed prior to shipment. All fans shall be certified by AMCA and carry its seal.

PART 2 - PRODUCTS

2.01 CENTRIFUGAL UP/DOWNBLAST FANS

A. Roof mounted exhaust fans shall be of the up or down blast direct drive type, as scheduled.

B. The fan housing shall fan housing shall consist of the motor cover, shroud, curb cap and lower windband, and shall be constructed of heavy-gauge aluminum. Housing shall have a rigid internal support structure and leakproof design. The fan shroud shall be one-piece with a rolled bead for extra strength, which directs exhaust air downward. The low windband shall be one piece with formed edges for added strength and the curb cap shall include prepunched mounting holes to ensure correct attachment to the roof.

C. The fan wheel shall be centrifugal, non overload, backward-inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

D. Upblast fans for use with kitchen exhaust or grease laden air shall be provided with a grease drain, grease cup and inspection and clean out access doors.

E. Motors shall be permanently lubricated and carefully matched to the fan loads. Motors shall be readily accessible for maintenance. Motors shall be mounted on true vibration isolators, out of the airstream. Each vibration isolator shall be sized to match the weight of each fan.

F. A NEMA 1 disconnect switch shall be provided as standard. Factory wiring shall be provided from motor to the handy box.

G. All fans shall bear the AMCA Certified Ratings Seal for both sound and air performance.

H. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

I. Fans shall be manufactured by Greenheck or approved equal.

2.02 DIRECT DRIVEN CENTRIFUGAL IN-LINE EXHAUST FANS

A. General Description:
   1. Base fan performance at standard conditions (density 0.075 Lb/ft3)
   2. Performance capabilities up to 5,000 cubic feet per minute (cfm) and static pressure to 1.75 inches of water gauge
   3. Fans are available in thirteen sizes with nominal wheel diameters ranging from 8 inches through 16 inches (60 - 160 unit sizes)
   4. Normal operating temperature up to 130 Fahrenheit (54.4 Celsius)
   5. Applications include: intake, exhaust, return, or make-up air systems
   6. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number

B. Wheel:
   1. Non-overloading, backward inclined centrifugal wheel
   2. Constructed of aluminum
   3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
   4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
   5. Single thickness blades are securely riveted or welded to a heavy gauge back plate and wheel cone.

C. Motors:
   1. AC Induction Motor
      a. Motor enclosures: Open dripproof
      b. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase

D. Housing/Cabinet Construction
   1. Construction material: Galvanized
   2. Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars
   3. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

E. Housing Supports and Drive Frame:
   1. Housing supports are constructed of structural steel with formed flanges

2. Drive frame is welded steel which supports the motor

F. Disconnect Switches:
1. NEMA rated: 1
2. Positive electrical shut-off
3. Wired from fan motor to junction box

G. Duct Collars:
1. Square design to provide a large discharge area
2. Inlet and discharge collars provide easy duct connection

H. Access Panel:
1. Two sided access panels, permit easy access to all internal components
2. Located perpendicular to the motor mounting panel

I. Options/Accessories:
1. Dampers:
a. Types: Gravity and motorized (see schedules on Drawing H2.0 for more information)
b. Galvanized frames with prepunched mounting holes
c. Balanced for minimal resistance to flow
2. Isolation:
a. Type: Neoprene/Rubber Mount
b. Sized to match the weight of each fan
3. Motor Cover:
a. Constructed of galvanized steel
b. Covers motor and drives for safety
c. Standard on unit specified with UL

J. Fans shall be Model SQ as manufactured by Greenheck or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Install fans, including all necessary structural supports and bracing as scheduled and located on the contract drawings in accordance with manufacturer's instructions and approved submittals.

B. Connect duct to fans to allow for straight and smooth air flow.

C. Provide flexible connections (minimum of 4") between fan and duct.

D. Install fan level: +/- 5 degrees vertical. Final installation shall be free of all leaks from both fan and associated ductwork.

3.02 START-UP, TESTING, DEMONSTRATION

A. Start-up fans after checkout to insure proper alignment and phased electrical connections.

B. Test fans individually and as part of system.

C. Insure supply / exhaust fans and dampers are properly interlocked, operate with control system as required to maintain building pressurization and exhaust per design documents and for proper building operation.

D. Provide all associated start-up and testing reports.

E. Demonstrate operation to Owner and instruct maintenance personnel in operation of equipment.

END OF SECTION 233416

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section describes the air terminals as specified herein, with capacities, distribution patterns and connection sizes as scheduled on the Drawings.

B. Products listed in Part 2 of this Section include:
   1. Grilles and Registers.
   2. Ceiling Diffusers.

1.02 RELATED WORK

A. Section 233113: Sheet Metal Work

1.03 REFERENCES

A. ADC 1062 GRD - Test Code for Grilles, Registers and Diffusers

B. ASHRAE 70 - Method of Testing for Rating the Airflow Performance of Outlets and Inlets.

C. ASHRAE 113 - Method of Testing Room Air Diffusion

D. ASTM C423 - Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

E. ARI 880 - Air Terminals

F. ARI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

G. NFPA 90A - Installation of Air Conditioning and Ventilation Systems

H. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

I. Mechanical Code of New York State

1.04 QUALITY ASSURANCE

A. Air Terminals will not be accepted until acoustical test results have been submitted and approved.

1.05 SUBMITTALS

A. Product data - Submit catalog cuts and installation instructions for all products specified, including standard color samples.

B. Submit published manufacturer’s performance data for all of the different types of diffusers, registers and grilles, based on testing in accordance with ASHRAE Standard 70, latest edition.

C. Performance data - For each size and type of air terminal , submit the following:
   1. Inlet static pressure in inches w.g.
   2. Maximum and minimum airflow in cfm.
   3. Throw in feet at maximum cfm (and 25 percent of cfm) for terminal velocities of 50 and 100 fpm.

4. Noise Criteria (NC) curve at maximum air terminal cfm rating with blades in full-open and closed positions.

PART 2 - PRODUCTS

2.01 CEILING DIFFUSERS

A. Stamped Ceiling Diffusers:
   1. Furnish and install stamped ceiling diffusers of the sizes and capacities as shown on the Drawings.
   2. Manufacture the diffuser from corrosion-resistant steel or extruded aluminum as indicated on the Drawings.
   3. Construct the diffuser with four die-formed concentric cones in all sizes. Construct the inner cone assembly to be removable using a spring clip arrangement that permits quick, easy installation and removal.
   4. Provide units with radial opposed blade dampers. Provide the diffuser with a removable plug for screwdriver adjustment of the damper without removing the inner core.
   5. Manufacture diffusers with trim to allow for recessed mounting in into ceiling grids or for surface mount in other ceiling types.
   6. Provide with molded fiberglass insulation blanket with foil back vapor barrier minimum R 4.2
   7. Manufacturer: Nailor Industries Inc, Model Series UNI, RNS or approved equal.
   8. Coordinate color with Owner

B. Round Ceiling Diffusers:
   1. Furnish and install round ceiling diffusers of the sizes and capacities as shown on the Drawings.
   2. Manufactured the diffuser from corrosion-resistant steel or extruded aluminum as indicated on the Drawings.
   3. Round, stamped or spun, multi-core diffuser to discharge air in 360 degree pattern, with sectorizing baffles where indicated. Size diffuser collar to project not more than one inch above ceiling.
   4. Provide a radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.
   5. Manufacture diffusers with trim to allow for recessed mounting into ceiling grids or for surface mount in other ceiling types.
   6. Manufacturer: Nailor Industries Inc. Model Series RNR or approved equal.
   7. Coordinate color with Owner.

C. Architectural Ceiling Diffusers:
   1. Furnish and install architectural ceiling diffusers of the sizes and capacities as shown on the Drawings.
   2. Manufacture the diffuser from corrosion-resistant steel or extruded aluminum as indicated on the Drawings.
   3. Construct the units of a stamped outer core and with the inner core having a plaque style face. Construct the face with a double skinned inner face panel with a hemmed edge. Manufacture the inner core assembly to be removable using a spring clip arrangement that permits quick, easy installation and removal.
   4. Manufacture diffusers with trim to allow for with face panel flush with the ceiling line into ceiling grids or for surface mount in other ceiling types.
   5. Provide an opposed blade radial volume damper, with an operating arm to adjust the damper without removing the core. Unit collar height; 1 ¼” in height.
   6. Provide an equalizing grid for field installation for each diffuser.
   7. Manufacturer: Nailor Industries Inc., Model Series UNI or approved equal.
   8. Coordinate color with Owner.

D. Architectural High Ceiling Perforated Diffusers:
   1. Furnish and install architectural high ceiling perforated diffusers of the sizes and capacities as shown on the Drawings.
   2. Manufacture the diffuser from corrosion-resistant steel.
   3. Construct the units of a stamped one-piece outer cone and a heavy gauge inner face panel with a hemmed edge.
   4. Perforated face shall have 3/8” diameter holes on 5/8” staggered centers.
   5. Provide an opposed blade radial volume damper, with an operating arm to adjust the damper without removing the core. Unit collar height; 1 ¼” in height.
   6. Manufacturer: Nailor Industries Inc., Model Series UNI-PD or approved equal.
   7. Coordinate color with Owner.

E. Architectural High Ceiling Adjustable Downblast Diffusers:
   1. Furnish and install architectural high ceiling perforated diffusers of the sizes and capacities as shown on the Drawings.
   2. Manufacture the diffuser from corrosion-resistant steel.
   3. Construct the units of a stamped one-piece outer cone and a inner core that has a square face plate and includes a round, easily adjustable radial vane in the center.
   4. The radial vane shall have a ring operator that allows for pole operation.
   5. Provide an opposed blade radial volume damper, with an operating arm to adjust the damper without removing the core. Unit collar height; 1 ¼” in height.
   6. Manufacturer: Nailor Industries Inc., Model Series UNI-AD or approved equal.
   7. Coordinate color with Owner.

2.02 RETURN GRILLES

A. Furnish and install return grilles of the type and size as shown on the Drawings. Construct the grilles with 45 degree deflection fixed blades and frames that have reinforced mitered corners.

B. Provide an opposed blade damper operable from the face of the grille for grilles connected to ductwork.

C. Manufacture grilles with trim to allow for recessed mounting into ceiling grids or for surface mount in other ceiling types. Provide concealed mounting using concealed mounting straps or concealed screw holes in neck. Countersunk screw holes in the frame face are not acceptable or frame face-mounting screws.

D. Construct the units of extruded aluminum or corrosion resistant steel as shown on the Drawings.

E. Manufacturer: Nailor Industries Inc, Model Series 6145H-O or approved equal.

F. Coordinate color with Owner.

2.03 HEAVY DUTY STEEL RETURN GRILLES

A. Furnish and install heavy duty return grilles of the type and size as shown on the Drawings. Construct the grilles with 45 degree deflection fixed 14 gauge steel blades spaced on ½” centers and a heavy duty 16 gauge steel welded frame.

B. Provide an opposed blade damper operable from the face of the grille for grilles connected to ductwork.

C. Manufacture grilles with trim to allow for recessed mounting into ceiling grids or for surface mount in other ceiling types. Provide concealed mounting using concealed mounting straps or

concealed screw holes in neck. Countersunk screw holes in the frame face are not acceptable or frame face-mounting screws.

D. Construct the units of extruded aluminum or corrosion resistant steel as shown on the Drawings.

E. Manufacturer: Nailor Industries Inc, Model Series 6145H-HD-O or approved equal.

F. Coordinate color with Owner.

2.04 HEAVY DUTY ALUMINUM RETURN GRILLES

A. Furnish and install heavy duty return grilles of the type and size as shown on the Drawings. Construct the grilles with 0 degree deflection aluminum blades spaced on ½" centers and a heavy duty aluminum welded frame.

B. Provide an opposed blade damper operable from the face of the grille for grilles connected to ductwork.

C. Manufacture grilles with trim to allow for recessed mounting into ceiling grids or for surface mount in other ceiling types. Provide concealed mounting using concealed mounting straps or concealed screw holes in neck. Countersunk screw holes in the frame face are not acceptable or frame face-mounting screws.

D. Construct the units of extruded aluminum or corrosion resistant steel as shown on the Drawings.

E. Nailor Industries Inc, Model Series 51FH-HD-OA or approved equal.

F. Coordinate color with Owner.

2.05 SUPPLY GRILLES

A. Furnish and install supply grilles of the type and size as shown on the Drawings. Construct the grilles with a dual set of streamlined shaped, roll-formed, corrosion-resistant blades that are adjustable, and spaced on ¾" centers and frame with reinforced mitered corners.

B. Manufacture grilles with trim to allow for recessed mounting into ceiling grids or for surface mount in other ceiling types. Provide concealed mounting using concealed mounting straps or concealed screw holes in neck. Countersunk screw holes in the frame face are not acceptable nor are frame face-mounting screws.

C. Construct the units of extruded aluminum or corrosion resistant steel as shown on the Drawings.

D. Manufacturer: Nailor Industries Inc., Model Series 61DH-O or approved equal.

E. Coordinate color with Owner.

2.06 TRANSFER GRILLES

A. Furnish and install supply grilles of the type and size as shown on the Drawings. Grilles shall be sight proof.

B. Construct the units of extruded aluminum or corrosion resistant steel as shown on the Drawings.

C. The grille shall have inverted “V” shaped blades and frames. The grille shall be sight-proof.

D. Manufacturer: Nailor Industries Inc., Model Series 61DGS or approved equal.

E. Coordinate color with Owner.

2.07 LINEAR DIFFUSERS

A. Furnish and install linear slot diffusers and accessories of the size and type shown on the drawings. Mechanical contractor shall coordinate installation with General Contractor and other subcontractors as required.

B. The linear slot diffuser shall utilize heavy wall extruded aluminum frames and be capable of supporting the ceiling system. Material shall be minimum wall thickness 0.06" (1.52). Diffuser frames shall be supplied with integral spacer bars and hanger brackets, spaced approximately on 24" (610) centers. In hard ceiling installations, provide support clips by the manufacturer that allow the diffusers to be secured to the ceiling diffuser opening framing channels.

C. The linear slot diffuser shall be complete with factory end border configurations as shown or indicated. Where exposed end caps are required, they shall be factory installed architectural mitered picture frame type. Flanges/butt type end caps are not acceptable.

D. Provide alignment strips and spline clips by the manufacturer to secure joints and ceiling tees to the linear diffuser as required. Mitered corner sections shall be supplied by the manufacturer in one-piece construction.

E. The air pattern controller shall be dual type on 24" (610) centers and fully adjustable to permit various air pattern configurations, as well as allow throttling, as required for air volume reduction or complete shut-off without adding any blank-off devices. Pattern controllers shall be minimum 20 ga. (1.01) corrosion-resistant steel. One-piece pattern controllers are not acceptable.

F. Linear slot diffusers shall incorporate vertical jet throw pattern controllers.

G. All diffusers shall have a single slot, unless shown otherwise, and shall be capable of being used for supply, return or exhaust air.

H. Supply air engineered plenum boots shall be minimum 22 ga. (0.85) coated steel and of the same manufacturer as the linear slot diffuser. Lengths and inlet sizes shall be as indicated on the plans and schedules. Where required, plenums shall be insulated with either internal matt faced fiberglass insulation or external foil back insulation, as specified on drawings or schedules. Return hood/sight baffles shall be provided as shown.

I. Pattern controllers and integral spacers shall be painted flat black.

J. Performance of the linear slot diffuser shall be based upon cataloged data obtained from tests conducted in accordance with ASHRAE Standard 70, latest edition. Pattern controllers shall be field adjusted after diffuser installation and set in their normal operating condition. Air test and balancing of linear slot diffusers shall be in accordance with the testing and balancing portion section of the specifications.

K. Provide manufacturers submittal drawings and published performance data.

L. Manufacturer: Nailor Industries Inc., Continuous Flowline Series Model FLV15 or approved equal.

2.08 LINEAR SLOT SUPPLY AND RETURN DIFFUSERS

A. Furnish and install linear slot diffusers of the type and size as shown on the plans and air distribution schedules.

B. The maximum length of a single section shall be 72” long. All sizes larger than 72” shall be provided in continuous multiple sections. Alignment strips shall be provided for joining continuous diffuser sections together.

C. The frame borders and end caps shall be extruded aluminum with extruded aluminum spacers.

D. The linear slot shall be supplied in 1 to 10 slots wide as specified.

E. Pattern deflectors shall have an aerodynamic ‘ice tong’ shape that can be adjusted to regulate the volume and direction of the airflow. The maximum length of the deflectors shall be 36”, longer sizes shall be provided in multiple sections. The pattern deflector finish shall be black.

F. Provide inactive sections with blank-offs, end caps, 90 degree mitered corners, etc. as necessary to provide a continuous appearance in areas with multiple section assemblies.

G. Manufacturer of Linear Slot Diffusers shall be Nailor Industries Inc., Model Series 5000 or approved equal.

H. Coordinate color with owner.

2.09 LINEAR SLOT DIFFUSER PLENUMS

A. Furnish and install plenums for linear slot diffusers of the sizes and capacities as shown on the plans and air distribution schedule.

B. The plenums shall be manufactured from corrosion-resistant steel and shall include a side inlet for connection to the duct.

C. The width shall fit a 1, 2, 3, or 4 slot linear diffuser as specified and the length shall be in standard nominal lengths of 20”, 24”, 30”, 36”, 48”, and 60”.

D. When continuous sections are required, the end caps shall be folded up for uninterrupted airflow.

E. Models 5310I, 5375I, and 5350I shall have internal insulation.

F. Manufacturer of Linear Slot Diffuser Plenums shall be Nailor Industries Inc., Model Series 5300 or approved equal.

2.10 LINEAR FLOOR DIFFUSERS

A. Furnish and install linear floor diffusers of the type and size as shown on the plans and air distribution schedules.

B. Linear floor diffusers shall be designed for installation in the floor.

C. The diffuser shall have 15 degree deflection bars set on ½” centers.

D. The entire assembly shall be constructed of etched and anodized extruded aluminum.

E. Manufacturer of Linear Floor Diffusers shall be Reliable Products Model LFD15 or approved equal.

F. Coordinate color with owner.

2.11 CURVED SPIRAL DUCT GRILLES

A. Furnish and install curved spiral duct grilles of the type and size as shown on the Drawings. Construct the grilles with a dual set of extruded aluminum blades that are spaced on ¾" centers. The frame shall be corrosion-resistant steel and rolled to match the specified radius.

B. Provide each unit with a damper extractor constructed of heavy gauge corrosion-resistant steel and operable from the face of the grille (Nailor Industries Inc. Model DEX).

C. Manufacturer: Nailor Industries Inc., Model Series 61DVC or approved equal.

PART 3 - EXECUTION

3.01 DIFFUSER, REGISTER AND GRILLE APPLICATION

A. See the Drawings for types, sizes, materials and installation requirements.

3.02 INSTALLATION

A. Install diffusers, grilles and registers in locations shown on the Drawings.

B. Consult the Drawings for type of ceiling in which the terminals are to be installed and match air outlet edge trim to the requirements of the ceiling type in which they are installed.

C. Install equalizing grids flush with take-off collar connection to supply duct with vanes perpendicular to air flow approaching diffuser.

D. Install in accordance with manufacturer's published recommendations as well as applicable sections of SMACNA manual and as specified above.

E. Install ceiling mounted grilles and registers with the blade deflection facing away from the line of sight.

F. Ductwork insulation, as required per insulation schedule, shall be continuous from supply duct mains, flex ducts (if applicable), up to, and sealed with supply diffuser molded insulation blanket with continuous vapor barrier, regardless of ceiling plenum condition.

G. Coordinate with other work, including ductwork and ductwork accessories, as necessary to interface installation of air outlets and inlets with other work

END OF SECTION 233713

PART 1 - GENERAL

1.01 PROVISIONS

A. Requirements of the General Mechanical Requirements of Division 23 and General Requirements of Division 1 applies to all work under this Section.

B. Throughout the specifications, types of materials may be specified by manufacturer's name and catalogue number in order to establish standards of quality and performance and not for the purpose of limiting competition.

1.02 WORK INCLUDED

A. Provide the following equipment as specified herein and in locations shown on drawings:
   1. Kitchen Hood and its appurtenances.

1.03 RELATED WORK

A. Section 233113: Sheet Metal Work

1.04 REFERENCES

A. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Operations

B. NFPA 17A - Standard for Wet Chemical Extinguishing Systems

C. UL - Underwriters Laboratories, Inc. (UL)

1.05 QUALITY CONTROL

A. The Kitchen Hood shall be constructed as UL listed and UL labeled, and shall bear the National Sanitation Foundation seal of Approval. The Kitchen Hood shall be built in accordance with NFPA # 96, and ASHRAE recommendations. The hood manufacturer shall provide on request, the necessary data that confirms compliance with above mentioned code authorities.

B. The Restaurant Fire Suppression System shall be constructed as UL listed and labeled and shall be constructed in accordance with NFPA # 96 and NFPA #17A.

C. All wiring and electrical equipment shall comply with NFPA 70, NEC.

1.06 SUBMITTALS

A. Submit shop drawings and product data to Engineer. Provide manufacturer’s data of the Hood design for this project. The data for the Hood shall also contain the data for the fire suppression system. Incomplete documents will be rejected.

PART 2 - PRODUCTS

2.01 COOKING EQUIPMENT KITCHEN HOOD

A. Acceptable manufacturers:

B. Captive Aire ND-2 Series with PSP Accessory or approved equal.

C. The exhaust only canopy hood shall be rated for all types of cooking equipment. The hood shall have the size, shape and performance specified on drawings.

D. Construction shall be type 430 stainless steel with a #3 or #4 polish where exposed. Individual component construction shall be determined by the manufacturer and ETL. Construction shall be dependent on the structural application to minimize distortion and other defects. All seams, joints and penetrations of the hood enclosure to the lower outermost perimeter that directs and captures grease-laden vapor and exhaust gases shall have a liquid-tight continuous external weld in accordance with NFPA 96. Hood shall be wall type with a minimum of four connections for hanger rods. Corner hanging angles have a 5/8" x 1-1/2" slot pre-punched at the factory, allowing hanging rods to be used for quick and safe installation.

E. Ventilator shall be furnished with U.L. classified high efficiency stainless steel baffle filters, supplied in size and quantity as required by ventilator. The filters shall extend the full length of the hood and the filler panels shall not be more than 6" in width.

F. The hood manufacturer shall supply complete computer generated submittal drawings including hood sections view(s) and hood plan view(s). These drawings must be available to the engineer, architect and owner for their use in construction, operation and maintenance.

G. Exhaust duct collar to be 4" high with 1" flange. Duct sizes, CFM and static pressure requirements shall be as shown on drawings. Static pressure requirements shall be precise and accurate; air velocity and volume information shall be accurate within 1-ft increments along the length of the ventilator.

H. U.L. incandescent light fixtures and globes shall be installed and pre-wired to a junction box. The light fixtures shall be installed with a maximum of 4’0" spacing on center and allow up to a 100 watt standard light bulb.

I. The hood shall have:
   1. A double wall insulated front. The insulation shall have a flexural modulus of 475 EI, meet UL 181 requirements and be in accordance with NFPA 90A and 90B.
   2. An integral front baffle to direct grease laden vapors toward the exhaust filter bank.
   3. A built-in wiring chase provided for outlets and electrical controls on the hood face and shall not penetrate the capture area or require an external chaseway.
   4. Removable grease cup for easy cleaning.

J. The hood shall be ETL Listed as "Exhaust Hood Without Exhaust Damper", ETL Sanitation Listed and built in accordance with NFPA 96. The hood shall be listed for 600°F cooking surfaces at 200 CFM/ft. The hood shall be ETL Listed as "Exhaust Hood Without Exhaust Damper".

K. Refer to drawings for additional accessories.

2.02 DISHWASHER HOOD

A. Acceptable manufacturers:
   1. Captive Aire VHB Series or approved equal.

B. The dishwasher hood shall be a single vent hood used for non-grease applications for the removal of heat, vapor, etc. The hood shall have size, shape, and performance as specified on the drawings.

C. The hood shall be constructed of type 304 stainless steel. Finish shall be #3 or #4 polish where exposed. The hood shall be wall type with fully welded 10-gauge corner hanging angles. Corner hanging angles shall have a slot pre-punched at the factory for use with hanging rods.

D. The hood manufacturer shall supply complete submittal drawings including hood section views and hood plan views. These drawings must be available to the engineer, architect, and owner for their use in construction, operation, and maintenance.

E. Exhaust duct collar to be 4” high with 1” flange. Duct sizes, CFM, and static pressure requirements shall be as shown on drawings. The hood shall be recognized by NSF.

F. Refer to drawings for additional accessories.

2.03 ANSUL R-102 RESTAURANT FIRE SUPPRESSION SYSTEM

A. The restaurant fire suppression system shall be an automatic fire suppression system using a wet chemical agent for grease related fires.

B. The system shall be pre-engineered in accordance with UL guidelines.

C. The system shall be installed and serviced by personnel trained by the manufacturer.

D. The system shall be capable of protecting cooking appliances by utilizing either dedicated appliance protection and/or overlapping appliance protection.

E. The system shall consist of a regulated release assembly that includes a regulated release mechanism and a wet chemical storage tank housed within a single enclosure. Nozzles, blow-off caps, detectors, cartridges, agent, fusible links, and pulley elbows shall be provided in the quantities needed for fire suppression system arrangements. Additional equipment shall include remote manual pull station, mechanical and electrical gas valves, pressure switches, and electrical switches for automatic equipment and gas line shut-off.

F. Wet Chemical Agent:
   1. The extinguishing agent shall be an aqueous solution of organic salts with a pH range between 7.8 - 8.2, designed for flame knockdown and foam securement of grease related fires.

G. Agent Tank:
   1. The agent tanks shall be installed in a stainless steel enclosure or wall bracket. The tank shall be constructed of stainless steel. The tank shall include an adaptor/tube assembly containing a burst disc union.

H. Regulated Release Mechanism:
   1. The regulated release mechanism shall be a spring-loaded, mechanical/pneumatic type capable of providing the expellant gas supply to the agent tank(s). It shall contain a factory installed regulator.
   2. It shall have automatic actuation by a fusible link detection system and remote manual actuation by a mechanical pull station.
   3. The regulated release mechanism shall contain a release assembly, regulator, expellant gas hose, and agent storage tank housed in a stainless steel enclosure with cover. The enclosure shall contain knock-outs for conduit. The cover shall contain an opening for a visual status indicator.
   4. The regulated release mechanism shall be compatible with mechanical gas shut-off devices; or, when equipped with a field or factory-installed switch, it shall be compatible with electric gas line or appliance shut-off devices.

I. Regulated Actuator Assembly:
   1. When more than two agent tanks are required, the regulated actuator shall be available to provide expellant gas for additional tanks. It shall be connected to the cartridge receiver

outlet of the regulated release mechanism providing simultaneous agent discharge. The regulator actuator assembly shall contain a regulated actuator, regulator, expellant gas hose, and agent tank housed in a stainless steel enclosure with cover. The enclosure shall contain knockouts to permit installation of the expellant gas line.

J. Discharge Nozzles:
   1. Each discharge nozzle shall be tested and listed with the R-102 system for the specific application. Nozzle tips shall be stamped with the flow number designation. Each nozzle shall have a metal or rubber blow-off cap to keep the nozzle tip orifice free of cooking grease build-up.

K. Distribution Piping:
   1. Shall be Schedule 40 black iron, chrome-plated, or stainless steel pipe conforming to ASTM A120, A53, or A106.

L. Detectors:
   1. Shall be the of the fusible link style designed to separate at a specific temperature.

M. Cartridges:
   1. Shall be a sealed steel pressure vessel containing either carbon dioxide or nitrogen gas. The cartridge seal shall be designed to be punctured by the releasing device supplying the required pressure to expel wet chemical agent from the storage tank.

N. Agent Distribution Hose:
   1. Kitchen appliances manufactured with or resting on casters (wheels/rollers), which have the Fire Suppression System hard piped, shall include a UL Listed agent distribution hose as a component of the suppression system. Hose assembly shall include a restraining cable kit.

O. Pull Station Assembly:
   1. The Fire Suppression System shall include a remote pull station for manual system actuation. The pull station shall be designed to include a built-in guard for pull handle protection. The pull station shall be red in color.

P. The Ansul system shall be manufactured by Tyco Fire Suppression & Building Products or approved equal.

2.04 KITCHEN HOOD CENTRIFUGAL UTILITY SET EXHAUST FANS

A. Utility set exhaust fan shall be suitable for use with a Type I kitchen hood serving cooking equipment that produces grease laden vapors. Fan shall be UL762 Listed for restaurant duty.

B. Fan shall have a vented motor cover.

C. Fan housing shall be continuously welded.

D. Fan shall have a clean out door.

E. Fan shall have a grease drain.

F. Provide exhaust fan model BI-CARM by CaptiveAire or approved equal.

2.05 DISHWASHER HOOD CENTRIFUGAL UTILITY SET EXHAUST FANS

A. Utility set exhaust fan shall be suitable for use with a Type II dishwasher hood serving a commercial type dishwasher.

B. Fan shall have a vented motor cover.

C. Fan shall be constructed with a corrosion resistant enamel finish.

D. Provide exhaust fan model BI-CA by CaptiveAire or approved equal.

2.06 KITCHEN HOOD CONTROLS

A. EMS Series control system by CaptiveAire.

B. Controls shall be listed by ETL (UL 508A).

C. The Energy Management System (EMS) shall be capable of saving energy during idle cooking periods. The EMS shall be designed to automatically reduce exhaust and supply airflow quantities while ensuring hood performance is maintained. The EMS shall use high and low speeds that shall be adjusted by variable frequency drives. A temperature switch in the exhaust duct shall control airflow set points and modulate the fans during cooking operation to maximize energy savings. A 100% airflow override button shall be supplied with an adjustable timer.

D. The control interface shall include (1) fan switch, (1) hood light switch, (1) 100% airflow override push button and indicator lights. Indicator lights shall include a "power" light, a "fans on" light, and a "100% airflow override" light. The control interface shall be screen printed on stainless steel and be able to be installed on the face of the hood, face of the utility cabinet, or on the face of the control enclosure.

E. The control enclosure shall be NEMA 1 rated and listed for installation inside of the exhaust hood utility cabinet. The control enclosure may be constructed of stainless steel or painted steel.

F. Variable frequency drives shall allow full adjustment of high speed and low speed airflows for proper kitchen balance. Drives shall contain motor thermal overload protection and control inputs for up to 7 preset speeds. Acceleration and deceleration times shall be fully adjustable as well as fan speed at each of the 7 different inputs. Drives shall also allow for a minimum and maximum frequency set-point. Drives are capable of controlling up to 5 HP each.

G. Adjustable temperature switch shall be mounted in the exhaust hood riser. One sensor shall be installed per exhaust fan. The temperature sensor shall be of the digital Resistance Temperature Detector (RTD) type. Temperature probe shall be constructed of Stainless Steel. Temperature switch shall be factory set at 130°F for 600°F cooking applications and 90°F for 400°F cooking applications. The temperature sensor shall be fully modulating and shall adjust on temperature changes. The riser mounted temperature sensor shall constantly monitor the exhaust air temperature and work in conjunction with a panel mounted temperature controller to modulate the system based on the temperature.

H. The timer shall contain one instantaneous contact and one delayed contact. Time shall be adjustable from .05 seconds to 30 days. Timer is energized with the 100% Airflow Override button. When button is depressed, time starts and fans go to high speed. Upon timeout, fans return to low speed or speed dictated by temperature switch.

I. The EMS shall be provided with a factory pre-wired panel capable of controlling up to four inverter duty motors. The control panel shall be factory pre-wired to shut down the supply fans in a fire condition.

2.07 ROOF MOUNTED, BELT DRIVE, UPBLAST CENTRIFUGAL EXHAUST FAN

A. Spun aluminum centrifugal roof exhausters are engineered to discharge grease laden vapors, fumes and other contaminants vertically away from the building.

B. All models shall be ETL Listed and comply with UL705 (electrical) and UL762 Standards and CSA Std C22.2, No 113. Fan shall bear the AMCA certified ratings seal for sound and air performance.

C. Housing: The fan windband shall be constructed of heavy gauge aluminum and shall be spun on an automatic lathe to provide consistent dimensions. Horizontal and vertical internal supports shall be used to securely fasten the windband to the discharge apron to provide rigidity for hinging and added strength to reduce shipping damage. The discharge apron shall have a rolled bead for added strength.

D. Base: The base shall be constructed of galvanized steel for improved rigidity. Base corners shall be welded to provide strength and support for hinging and cleaning and to prevent leakage into the building.

E. Wheel: The fan wheel shall be centrifugal backward inclined and non-overloading. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be welded to the wheel inlet cone. In the event that balancing weights are required they shall be riveted to the blades or wheel. The wheel inlet shall overlap the fan base inlet for maximum performance and efficiency. The wheel shall be firmly attached to the motor shaft with two set screws.

F. Motor and motor Compartment: Motors shall be heavy duty ball bearing type, mounted out of the airstream and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel and isolated from the fan structure with vibration isolators. The motor compartment shall be cooled by outside air drawn through an extruded aluminum conduit tube. To seal the conduit tube passage and prevent noise silicone rubber grommets shall isolate the conduit tube from the fan housing. The motor compartment shall be of a two-piece construction with the top cap having quick release clips to provide quick and easy access to the motor compartment.

G. Shaft and Bearings: Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for and individually tested specifically for use in air handling applications.

H. Belts and Drives: Belts shall be oil and heat resistant, non-static type. Drives shall be cast type, precision machined and keyed and secured attached to the fan and motor shafts. Drives shall be sized for a minimum of 150% of the installed motor horsepower. Fan operating speed shall be factory set using adjustable pitch motor pulleys.

I. Grease Spout: A grease spout made of aluminum tubing shall be welded to the fan housing. The weld shall be factory tested to ensure it will not leak.

J. Nylon Washers: To provide a tight seal all fasteners in the fan housing shall be backed with nylon washers.

K. Safety Disconnect Switch: A safety disconnect switch shall be standard on all NCA-FA units with open drip proof motors. Switches shall be installed in a NEMA3R enclosure and mounted to exterior of windband for easy access.

L. Provide exhaust fan model NCA-FA by CaptiveAire.

2.08 INLINE DIRECT GAS FIRED HEATED MAKE UP AIR UNIT

A. A Modular Packaged Heating, Cooling and ventilating unit(s), as indicated on the drawings shall be furnished. Direct Fired Gas Unit(s) shall be tested in accordance with ANSI Standard Z83.4a-2001/CSA 3.7a-2001, and shall bear the ETL label. Orientation shall be horizontal, down or side discharge. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for outdoor mounting, consisting of the following:
   1. Gas burner
   2. Centrifugal blower (forward-curved double width/double inlet)
   3. Motor starter with thermal overload protection
   4. Motor and drive assembly
   5. Fuel burning and safety equipment
   6. Temperature control system
   7. Gas piping
   8. Pre-piped and charged condenser(s)

B. Housing:
   1. Unit housing shall be constructed of 20 gauge G-90 galvanized steel. The wall panels and roof panels shall be fabricated by forming double-standing, self-locking seams that require no additional support. The floor and wall panels shall be caulked air tight with a silicone caulk. All casing panels shall be attached with sheet metal screws or rivets, which can be removed to field service large components. The unit base shall be suitable for curb or flat mount. Housing construction should be suitable for outdoor installation.
   2. An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the burner vestibule. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream. The vestibule full-size door shall provide easy access to controls and gas-train components. Blower door shall provide easy access to blower, motor and drives. Access doors shall be provided on both front and backside of unit providing full access to every part of the unit.
   3. Internal ridged board 1" x 1.5” foil face installation shall be installed on roof, walls and base of casing.

C. Base:
   1. The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.

D. Blower:
   1. Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on application requirements), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft. Wheels shall be balanced in two planes and done in accordance with AMCA standard 204-96, Balance Quality and Vibration Levels for Fans. The wheel blades shall be aerodynamically designed to minimize turbulence, increase efficiency and reduce noise. The wheel blades shall be securely attached to the wheel inlet ring. The wheel shall be firmly attached to the fan shaft with setscrews and keys. The blower assembly shall be isolated from the fan structure with vibration isolators.
   2. Blower capacity shall be as noted on the drawings.
   3. All blowers shall be tested and set at rated speed after being installed in the factory-assembled unit.

E. Motor and Motor Compartment:
   1. Motors shall be heavy-duty ball bearing type and furnished at the specified voltage, phase and enclosure. Motor mounting plate shall be constructed of heavy gauge galvanized steel

and shall be designed to provide easy adjustment of the belt tension. Blower motor shall be Open Drip Proof.

F. Shaft and Bearings:
   1. Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings shall be selected for a minimum (L50) life in excess of 200,000 hours of operation at maximum cataloged operating speed. They shall be designed for, and individually tested, specifically for use in air handling applications.

G. Belts and Drives:
   1. Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed, and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys. All drives shall be a minimum of 2 grooves above 2 HP.

H. Burner:
   1. The gas burner shall be direct-fired, draw-through type, sized to provide the output capacity noted on the drawings using natural gas.
   2. The burner shall burn over its entire length at all times when the system is in operation.
   3. The burner shall have non-clogging, 4302B stainless-steel combustion baffles attached to a ductile aluminum gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of up to 30 to 1.
   4. The gas burner shall be furnished with a pilot package arranged so that the pilot flame lights the burner with instantaneous ignition. Pilot assembly includes a flame rod, spark rod and pilot, which is automatically ignited by ignition transformer. A flame-rod rectification system shall be used to prove pilot and main flame.
   5. Rear access doors will provide complete access to burner and pilot assembly.
   6. Burner profile plates shall be self-adjusting to operate across the complete CFM range of each model heater. Every unit shall be designed for Variable Air Volume capabilities.

I. Cooling Equipment:
   1. All cooling equipment should conform to local code requirements. All gas manifold components shall be piped and wired at the factory.
   2. Components shall include:
      a. 14 SEER minimum condenser
      b. Thermal Expansion Valve
      c. Filter/Dryer
      d. Hard Start Kit for Condenser
      e. Insulated Suction Lines
      f. Multiple Stages where required
      g. Pre Charged System
      h. R-410A Refrigerant

J. Gas Equipment:
   1. All gas equipment should conform to local code requirements. All gas manifold components shall be piped and wired at the factory.
   2. Components shall include:
      a. Pilot-gas shut-off valve
      b. Pilot-gas regulator
      c. Pilot-gas valve
      d. Main-gas shut-off valve
      e. Main-gas regulator
      f. Two solenoid valves
      g. Modulating-gas valve

h. Burner on gas equipment

K. Safety Controls:
1. Safety controls shall include:
a. Motor starter with adjustable overloads
b. Air-flow safety switch
c. Electronic flame-safety relay
d. High-temperature limit switch
e. Main-gas regulator
f. Two safety shutoff valves
g. Modulating-gas valve
h. Stainless Steel Burner
i. Adjustable burner ON/OFF inlet air duct-stat to shut off heat when inlet air is sufficiently warm to maintain space temperature
j. Non-Fused Disconnect
k. Casing insulation shall be 1” x 1.5" density with a foil face
l. Low gas-pressure switch

L. Accessories shall include, but not be limited to, the following:
1. Inlet Dampers: Manufacturer shall provide and install on unit, when possible, a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16-gauge G-90 galvanized steel and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals used are flexible metal, compression type.
2. Fresh-Air Inlet Hood/Filter Combination: Shall be constructed of G-90 galvanized steel with bird screen and (2") cleanable filters supported by internal slides mounted in the inlet face of the hood.
3. Curb: 20" curb shall be constructed of 18-gauge aluminized steel as a completed welded assembly.
4. Cooling Coil Section: Cooling coil section shall be field bolted directly to discharge of blower section. Coil section to be designed to fit onto common curb with main unit. Base of coil section to be constructed with double pitch stainless steel drain pan for coil, same as main unit. Casing and roof to be 20-gauge G-90 galvanized construction. Inside of section to be fully insulated with foil back insulation. DX or chilled water coil to meet scheduled requirements.

M. Temperature Control Systems:
1. Discharge Temperature Control: Use for building exhaust-air replacement to maintain a constant discharge temperature of supply air. The burner flame modulates to compensate for outdoor temperatures. The optional manual SUMMER-OFF/WINTER selector switch and exhaust system interlock controls the heater-blower operation. Supplied with optional remote-control panel with temperature selector dial and SUMMER-OFF/WINTER selector.

N. Wiring and Electrical:
1. Each condenser shall have a separate circuit enabling the supply fan motor to accept signals from a VFD without interfering with condenser operation.
2. Unit(s) shall be complete with all items such as relays, starters, switches, safety controls, conduit and wire as previously mentioned, and as required for proper operation. All factory-mounted controls shall be factory pre-wired to the unit control panel. A safety disconnect switch shall be standard on all units and shall be sized according to the unit.

O. Unit(s) shall be operated, tested and set at the factory using job-site conditions for electrical and gas input. All operating and safety controls shall be tested and set at the factory. Adjustable or

fixed sheaves shall be set for proper RPM at specified conditions. Gas-pressure regulator shall be set for specified burning rate at specified inlet pressure.

P. The supplier shall furnish as built wiring connection and control-circuit diagrams, dimension sheets and a full description of the unit(s). Service manuals, showing service and maintenance requirements, shall be provided with each unit.

Q. Modular Packaged Cooling Unit with Direct-Fired Heated for 100% Outdoor Air applications shall be model A3-D.500-G18 by CaptiveAire.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install kitchen hood in locations shown on drawings.

B. Installation to be in accordance with manufacturer's published recommendations as well as applicable sections of SMACNA manual and as specified above.

C. Provide all steel structural support screws, bolts, nuts, inserts, and material required for installation of the Hood against the wall and for attaching exhaust and supply ducts to the Hood.

D. Install complete fire suppression system for each hood.

E. Provide all interlocks between suppression system, exhaust fans, and make-up air fans. Electrical contractor shall provide all relays between fire suppression system and fire alarm panel.

3.02 EXHAUST FANS

A. Ensure enough clearances are around unit as recommended by the manufacturer and NFPA standard.

B. Connect duct to fans to allow for straight and smooth airflow.

C. Provide hard connection to duct work. The fan shall be connected to the ductwork by flanges securely bolted. Do not use flexible connectors. Connections shall be made as per NFPA 96. Use 1500 deg F rated gaskets.

3.03 INLINE MAKE UP AIR UNIT

A. Ensure enough clearances are around unit as recommended by the manufacturer and NFPA standard.

B. Avoid transitions and turns near the outlet of the fan.

3.04 TESTING

A. Check work for satisfactory installation and performance.

B. Check duct connections for leakage or condensation. Correct any deficiencies.

C. Test the performance of kitchen exhaust system. Adjust dampers for proper direction of air flow. Conduct final test of hood and hood fire suppression system in the presence of the Engineer.

END OF SECTION 233813

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of heat exchangers work required by this section is indicated on drawings and schedules, and by requirements of this section.

B. Types of heat exchangers required for project include the following:
   1. BELOW ARE EXAMPLES ONLY. EDIT TO SUIT PROJECT REQUIREMENTS.
   2. Steam-to-water U-tube heat exchangers.
   3. Water-to-water U-tube heat exchangers.
   4. INSERT MORE DETAILED DESCRIPTION OF EACH TYPE RETAINED ABOVE, TO REFLECT SCOPE OF WORK.
   5. Refer to other Division-15 sections for insulation of heat exchangers; not work of this section.
   6. Refer to other Division-15 sections for piping, valves, specialties, and controls required in conjunction with heat exchangers; not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers Qualifications: Firms regularly engaged in manufacture of heat exchangers, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. POSSIBLY REVISE "5 YEARS" ABOVE, AS DESIRED. DELETE IF PROPRIETARY OR SEMIPROPRIETARY SPECIFICATION IS USED.

C. Codes and Standards:
   1. ASME Compliance: Construct heat exchangers in accordance with ASME Boiler and Pressure Vessel Code, Section VIII "Pressure Vessels", Division 1.
   2. TEMA Compliance: Construct and install heat exchangers in accordance with "Standards of the Tubular Exchanger Manufacturers Association".
   3. ABOVE STANDARD COVERS DESIGN AND INSTALLATION OF HEAT EXCHANGERS.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's specifications for heat exchanger including performance data, materials, dimensions, weight, required clearances, and installation data. Submit Manufacturers' Data Report for Pressure Vessels, Form U-1, as required by provisions of ASME code rules.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and parts list for each type of heat exchanger. Include this data in maintenance manual.

D. EDIT 3 PARAGRAPHS ABOVE TO SUIT PROJECT REQUIREMENTS AND OFFICE PRACTICE. COORDINATE WITH DIVISION-1 REQUIREMENTS.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle heat exchangers carefully to prevent damage, breaking, denting, and scoring. Do not install damaged units or components; replace with new.

B. Store heat exchangers in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading heat exchangers and moving them to final location.

PART 2 - PRODUCTS

2.01 STEAM-TO-WATER U-TUBE HEAT EXCHANGERS

A. General: Provide steam-to-water U-tube heat exchangers as indicated, of capacity as scheduled, and as specified herein.

B. Type: Shell and tube, U-bend removable tube bundle, steam in shell, water in tubes, equipped with mounting legs.

C. Materials:
1. Shell: Steel.
2. Tubes: 3/4" O.D. copper.
3. Heads: Cast iron or steel.
4. Tube Sheets: Steel.
5. Tube Supports: Steel.

D. EDIT ABOVE TO SUIT PROJECT REQUIREMENTS.

E. Construction: ASME construction for 125 psi design pressure at 375 deg F (190 deg C).

F. EDIT ABOVE TO SUIT PROJECT REQUIREMENTS.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering steam-to-water U-tube heat exchangers which may be incorporated in the work include, but are not limited to, the following:
1. RETAIN ABOVE OR BELOW, FOR NONPROPRIETARY OR SEMIPROPRIETARY SPECIFICATION.

H. Manufacturer: Subject to compliance with requirements, provide steam-to-water U-tube heat exchangers of one of the following:
1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett ITT; Fluid Handling Div.
4. Dunham-Bush Inc.
5. Patterson-Kelley Co; Div. of Harsco.
6. Precision Heat Exchanger Co.
7. Taco, Inc.

2.02 WATER-TO-WATER U-TUBE HEAT EXCHANGERS

A. General: Provide water-to-water U-tube heat exchangers as indicated, of capacity as scheduled, and as specified herein.

B. Type: Shell and tube, U-bend removable tube bundle, heating water in shell, heated water in tubes.

C. Materials:
   1. Shell: Steel
   2. Tubes: 3/4" O.D. copper.
   3. Heads: Cast iron or steel.
   4. Tube Sheets: Steel.
   5. Baffles, Tie-Rods, Spacers: Steel.

D. EDIT ABOVE TO SUIT PROJECT REQUIREMENTS.

E. Construction: ASME construction for 125 psi design pressure at 300 deg F (149 deg C).

F. EDIT ABOVE TO SUIT PROJECT REQUIREMENTS.

G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering water-to-water U-tube heat exchangers which may be incorporated in the work include, but are not limited to, the following:
   1. RETAIN ABOVE OR BELOW, FOR NONPROPRIETARY OR SEMIPROPRIETARY SPECIFICATION.
   2. Manufacturer: Subject to compliance with requirements, provide water-to-water U-tube heat exchangers of one of the following:
      a. Amtrol, Inc.
      b. Armstrong Pumps, Inc.
      c. Bell & Gossett ITT; Fluid Handling Div.
      d. Dunham-Bush Inc.
      e. Patterson-Kelley Co; Div. of Harsco
      f. Precision Heat Exchanger Co.
      g. Taco, Inc.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which heat exchangers are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 STEAM-TO-WATER U-TUBE HEAT EXCHANGERS

A. General: Install steam-to-water U-tube heat exchangers as indicated, and as specified herein.

B. Mounting: Mount heat exchangers on steel floor stands as indicated, located for required clearance for tube bundle removal.

C. DELETE ABOVE OR BELOW.

D. Mounting: Mount heat exchangers on trapeze hangers as indicated, located for required clearance for tube bundle removal.

E. Steam Piping: Provide piping as indicated, including control valve with 3-valve bypass, strainer, and pressure gage on inlet; condensate dirt leg, steam trap with 3-valve bypass, strainer, and check valve on outlet; air vent or vacuum breaker on shell.

F. Water Piping: Provide piping as indicated, including union, shutoff valve, and thermometer on inlet; union, shutoff valve, relief valve, and thermometer on outlet. Pipe relief valve outlet to floor drain.

G. EDIT ABOVE 2 PARAGRAPHS TO SUIT PROJECT REQUIREMENTS. DELETE BOTH PARAGRAPHS IF ADEQUATE PIPING SCHEMATIC IS SHOWN ON DRAWINGS.

3.03 WATER-TO-WATER U-TUBE HEAT EXCHANGERS

A. General: Install water-to-water U-tube heat exchangers as indicated, and as specified herein.

B. Mounting: Mount heat exchangers on steel floor stands as indicated, located for required clearance for tube bundle removal.

C. DELETE ABOVE OR BELOW.

D. Mounting: Mount heat exchangers on trapeze hangers as indicated, located for required clearance for tube bundle removal.

E. Water Piping: Provide piping as indicated, including union, shutoff valve, and thermometer on each inlet and outlet connection; relief valve on tube bundle outlet, with outlet piped to floor drain; and 1/2" drain valve on shell drain connection.

F. EDIT ABOVE TO SUIT PROJECT REQUIREMENTS. DELETE IF ADEQUATE PIPING SCHEMATICS IS SHOWN ON DRAWINGS.

3.04 ADJUSTING AND CLEANING

A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 SPARE PARTS

A. General: Furnish to Owner, with receipt, one spare gasket for each flanged connection for each heat exchanger.

B. EDIT ABOVE TO SUIT OFFICE PRACTICE.

END OF SECTION 235700

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Condensing unit package

B. Charge of refrigerant and oil

C. Controls and control connections

D. Refrigerant piping connections

E. Motor starters

F. Electrical power connections

G. Concrete Pads

H. Roof Rails

1.02 RELATED SECTIONS

A. Section 230993 - Sequence of Operations

B. Section 232300 - Refrigeration Piping.

C. Section 237313 - Air Handling Units

1.03 REFERENCES

A. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.

B. ANSI/ASHRAE/IES 90 A - Energy Conservation in New Building Design Standard.

C. AHRI 210/240 - Unitary Air-Conditioning Equipment and Air-Source Heat Pump Equipment, (units less than 135,000 Btuh).

D. AHRI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard (condensing units greater than 135,000 Btuh).

E. AHRI 340 - Commercial and Industrial Unitary Heat Pump Equipment, (heat pumps greater than 135,000 Btuh).

F. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.

G. California Energy Commission Administrative Code - Title 20/24 - Establishes the minimum efficiency requirements for HVAC equipment installed in new buildings in the State of California.

H. AHRI 270 - Sound Rating of Outdoor Unitary Equipment, (units less than 135,00 Btuh).

I. AHRI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment (equipment above 135,000 Btuh).

1.04 SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units on site from physical damage. Protect coils.

1.06 WARRANTY

A. Provide parts warranty for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide 5 year compressor warranty.

1.07 MAINTENANCE SERVICE

A. Furnish complete parts and labor service and maintenance of packaged roof top units for one year from Date of Substantial Completion by contractor.

B. Provide maintenance service with a two month interval as maximum time period between calls. Provide 24 hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data.

D. Submit copy of service call work order or report and include description of work performed.

1.08 REGULATORY REQUIRMENTS

A. Unit shall conform to ANSI Z21.47/UL 1995 for construction of packaged air conditioner.

B. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

PART 2 - PRODUCTS

2.01 SUMMARY

A. The contractor shall furnish and install air-cooled condensing units as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. APPROVED MANUFACTURERS
1. Trane

2. Substitutions: Prior approval required as indicated under the general and/or supplemental conditions of these specifications.

C. Base Bid shall be Trane air-cooled condensing units with approved alternate being Carrier or York. Alternates must still comply with the performance and features as specified with these specifications and as indicated on the design documents. Job will be awarded on basis of specified product. Substitutions must be selected and approved within 14 calendar days after award of contract.

2.02 GENERAL UNIT DESCRIPTION

A. Provide self-contained, packaged, factory-assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressor(s), condensing coil and fan(s), integral subcooling circuit(s), filter drier(s), and controls. Provide expansion valve(s) and check valves for split system heat pump unit(s).

B. Performance Ratings: Energy Efficiency Rating (EER) not less than prescribed by ANSI/ASHRAE 90A.

2.03 CASING

A. House components in 18 gauge zinc-coated galvanized steel frame and panels with weather resistant, baked enamel finish. Units surface shall be tested 500 hours in salt spray test.

B. Mount controls in weatherproof panel provided with removable panels and/or access doors with quick opening fasteners.

2.04 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide subcooling circuit(s). Factory leak test under water to 450 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

2.05 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Fans shall be statically and dynamically balanced.

B. Weatherproof motors suitable for outdoor use, with permanently lubricated totally enclosed or open construction motors shall be provided and shall have built in current and thermal overload protection. Motors shall be either sleeve or ball bearing type.

2.06 COMPRESSORS

A. Compressors: direct drive scroll compressors with integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads. Provide external high and low pressure cutout devices.

2.07 CONTROLS

A. Provide factory-wired condensing units with 24 volt control circuit with internal fusing and control transformers, contactor pressure lugs and/or terminal block for power wiring. Contractor to provide field installed unit mounted disconnect switch. Units shall have single point power connections.

2.08 STAGING CONTROLS

A. Provide NEC Class II, electronic, adjustable zone control to maintain zone temperature setting.

B. Provide 24 volt, adjustable thermostat to control heating and cooling stages in sequence with delay between stages, and supply fan to maintain temperature setting.
   1. Locate thermostat in room as shown on plans.

2.09 BUILDING MANAGEMENT SYSTEM

A. Interface control module to Energy Management System to be furnished and mounted by unit manufacturer. Through this interface module, all Energy Management functions (specified in Energy Management Section) shall be performed. See Building Automation and Automatic Temperature Control System Specifications. The interface module with necessary controls and sensors shall all be factory mounted (not field mounted). If not furnished by unit manufacturer, this shall be furnished by Energy Management System Contractor for factory mounting by rooftop unit manufacturer in rooftop unit and rated for service up to 140 F. The only field connection to Energy Management System shall be a single communication link.

B. Control Functions: Include unit scheduling, occupied/unoccupied mode, start-up and coast-down modes, demand limiting, night setback, timed override and alarm shutdown.

C. Diagnostic Functions: Include supply fan status, , and a field supplied and installed sensor, to provide a dirty filter alarm.

D. Provide capabilities for Boolean Processing and trend logs as well as "templated" reports and logs.

2.10 MISCELLANEOUS FEATURES

A. Neoprene Isolators: Provide field-installed rubber-in-shear isolators.

B. Low Ambient Control: Electronic head pressure control that allows operation to 0 degrees F outdoor ambient.

C. Condenser Coil guard: Metal grille with Polyvinyl chloride coating to cover condenser coil area.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Where required by Code and/or as indicated on drawings and/or schedules:
   1. Install units on vibration isolation.
   2. Provide seismic / shear restrained mounts as indicated.

B. Install units on concrete pad, roof rails, or dunnage as indicated on drawings and/or schedules.

C. Install in accordance with manufacturer's instructions.

D. Provide connection to refrigeration piping system and evaporators

E. Prepare for connection to electrical service. Coordinate all required electrical connections with electrical contractor.

F. Provide connection to control wiring and controls integration as specified by contract.

END OF SECTION 237213

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Outdoor roof curb mounted, electronically controlled, heating and cooling unit utilizing hermetic scroll compressors with crankcase heaters for cooling duty and gas combustion for heating duty. Units shall discharge supply air vertically or horizontally as shown on contract drawings.

1.02 RELATED SECTIONS

A. Sheet Metal Work: Section 233113.

B. Division 26.

1.03 SUBMITTALS

A. Shop Drawings: Submit drawings for each size of factory fabricated roof curb.

B. Product Data: Manufacturer’s catalog sheets, brochures, performance charts, standard schematic drawings, specifications and installation instructions for each size unit.

C. Contract Closeout Submittals - Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Owner's Representative.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Unit shall be factory tested and the design, construction and installation shall be in accordance with the following: ARI Standard 210, NFPA, ASHRAE 15 (latest edition), Safety Code for Mechanical Refrigeration, and all State and Local codes or regulations having jurisdiction.
   2. Unit shall be listed by ETL as a total package.
   3. Rate cooling capacities in accordance with ARI Standard 210.
   4. Electrical components shall be UL listed.
   5. Gas heat equipped units shall be designed to conform with ANSI Standard Z21.47, Gas-Fired Central Furnaces.
   6. Roof curb shall be designed to NRCA criteria per Bulletin B-1986.
   7. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

1.05 PRODUCT DELIVERY

A. Unit shall be stored and handled as per manufacturer's recommendations.

B. Deliver each unit as an integral factory packaged assembly.

1.06 MAINTENANCE

A. Maintenance Service: A fully equipped authorized service organization capable of guaranteeing response within 8 hours to service calls shall be available 24 hours a day, 7 days a week to service the completed Work.

B. Extra Materials: Provide with each unit, one spare set of air filters. Suitable box and label spare filters as to their usage.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. A. General Specification
1. Furnish and install Model YDMA-Size package DX system for the treatment of up to 100% constant outside air per plans and specifications. Unit(s) shall be completely factory assembled, tested, internally wired, fully charged with Refrigerant R410A, and shipped in one piece.
2. Unit(s) shall consist of insulated weather-tight casing with optional field installed outdoor intake hood, modulated capacity scroll compressors, air-cooled condenser coils, condenser fans, evaporator coils, direct drive supply fan, factory installed VFD, and unit controls.
3. Packaged Cooling and Heating Units shall carry an ETL listing. Manufacturer must have at least 20 years experience in manufacturing makeup air equipment.

B. Refrigerant System
1. Compressor systems shall be designed to provide 10 - 100% capacity control for treatment of up to 100% outside air with up to 80 degree dewpoint entering the unit. Hermetic compressors shall include a scroll design with internal pressure relief and motor temperature winding protection.
2. Units shall be equipped with reversal rotation protection. Refrigeration protection shall include low and high pressure switches, refrigerant circuit frost protection, liquid line filters/dryers and service gage ports. Refrigeration control shall include thermal expansion valves, external equalizers and distributors for each compressor.
3. Hot gas bypass options shall be available on all refrigerant stages in addition to multiple steps of capacity modulation to supplement discharge air control.
4. The refrigerant system shall have an adjustable 5 minute minimum ON and minimum OFF timer circuit protection. The refrigerant circuit shall have an anti-cycle time in addition to the minimum ON/OFF timer that prevents the compressors from cycle on the minimum timer circuit. The unit shall have optional low ambient kit.
5. The condensate drain pan shall be corrosion proof material. The drain outlet shall be double sloped drain pan with a minimum 1/8” per foot slope. The sloped drain pan shall be of a removable design. The drain pain shall collect potential condensate from all evaporator/condenser coils and distributor area in the air stream to prevent blow-off condensate reaching unprotected bottom unit surfaces.

C. Reheat Systems
1. Model shall include a dedicated modulating compressor and refrigeration circuit using full condenser reheat or total heat of rejection in the supply airstream. The circuit shall be capable of delivering a nominal 13°F- 17°F temperature rise from the main evaporator temperature without the need for modulating the capacity for all entering outside air conditions. The compressor shall modulate to maintain other than neutral air conditions per customer adjusted setpoint.
2. All methods of reheat shall comply with ASHRAE 90.1 requirements. Dual compressor systems shall be designed to provide 4-8 stage capacity increment using integrated DDC control. The refrigerant circuits shall include thermal expansion valves with external equalizers. Service gage ports and refrigerant line filter dryers are factory installed as standard. Pre-cooling coils shall be two row depth with 6 fin per inch to minimize air pressure drop. The reheat coil position shall include a minimum separation of 6” from the cooling coil to eliminate re-evaporation of cooling coil condensate.

D. Evaporator and Condenser Coils
1. The refrigerant system shall include a horizontal discharge air cooled condenser. The copper tube-aluminum plate fin evaporator coil to be 4 rows with 15 fins per inch to meet

SHR values of 0.60. All multi-circuit evaporator coils are of the interlaced and split face configuration to reduce the risk of coil freezing at part load. All evaporator coils shall be protected from frosting by a low temperature cutout. All Coils shall be leak tested at the factory to ensure pressure integrity. [Coils shall have ElectroFin™ coating for protection from corrosion].

2. The condenser coils shall be aluminum micro-channel type condensing coil [A coil guard will be included for protecting the condensing section.] Units will ship completely charged for immediate operation upon installation and check-out of the unit.

E. Gas Heat (Natural)
   1. Heating shall be provided by a gas-fired heating section designed to provide a 5:1 power vented modulation with a minimum 80% thermal efficiency throughout the modulated range. The system shall modulate the gas and combustion air to maintain temperature setpoint and thermal efficiency.
   2. The heat exchanger shall be capable of 100 degree temperature rise for 100% outside air treatment. The heating system shall be factory installed and design certified to ANSI Standard Z83.8/CSA 2.6. The heat exchanger shall be tubular design constructed of 409 stainless steel.
   3. The gas burner shall be direct spark, multi-try, with a flame sensing circuit monitored by an electronic flame supervision system with 100% lockout via an integrated circuit board that incorporates LED diagnostics. Diagnostic codes shall include failed ignition.
   4. Certifications: The gas heat sections shall be approved to ANSI Z83.8/CSA 2.6. The packaged unit shall be certified to UL-1995 - UL Standards for Safety Heating & Cooling Equipment Second Edition: CAN/CSA C22.2 NO. 236-95. Safety Features: All heat sections for said unit shall feature factory installed:
      a. Automatic discharge air limit control
      b. Air proving pressure switch
      c. Color coded wiring and matching terminal blocks
      d. Circuit breaker protected transformers

F. Electric Heat
   1. Manufacturer to provide factory installed electric resistance heat for unit. Unit shall include field-replaceable heat sections. All heat sections are to be sub-fused. Heat sections shall feature SCR control with 0-100% capacity modulation.

G. Cabinet
   1. Outer casing is fabricated from G90 galvanized steel substrate with 60 gloss painted finish coat. Structural members shall be 18 gauge with double-wall foamed construction panel for all exterior surfaces.
   2. The unit shall have an overall R13 insulation value.
   3. The cabinet design shall prevent condensation forming on the outside of the unit casing in operation. Fully gasketed, hinged doors of double-wall foam construction shall provide access to filters, dampers, evaporator coils section, supply fan section, energy recovery wheel and exhaust fan. Provide hinged single wall construction doors for the heater section and control section. The unit shall have lockable door access.
   4. The unit control panel section shall be laid out to provide separation of high and low voltage components per UL standards. High voltage wiring shall be touch safe utilizing power distribution rails, race ways and wiring harnesses. The control panels shall be hinged for easy access to the unit controls. For ease of service, all electrical components will be clearly identified with 1/2” diameter self adhesive labels to match the unit specific wiring diagram. The low voltage and unit controller access electrical panel shall be physically isolated from the high voltage section. The open door to the control section will reveal the wiring diagrams, DDC programming instructions and all manuals and literature protected and permanently attached to the cover. All control transformers will incorporate integral, resettable circuit breaker protection.

5. An optional weatherproof convenience outlet will be accessible from the outside of the unit without the removal of any doors or access panels.

H. Air Side
1. The outdoor condenser fan shall be direct drive, statically and dynamically balanced, draw through in the vertical position. The condenser fan motor(s) shall be permanently lubricated and have built-in thermal overload protection. [Optional high efficiency ECM motors shall be provided with speed control directly connected to the unit control system.] The fan sled shall be direct drive with an ABB variable frequency drive allowing peak fan efficiency and system RPM.
2. The fan system shall utilize Ziehl-Abegg patented rotating diffuser which reduces noise and helps increase overall system efficiency. The fan sled shall have slide out design for easy inspection and replacement. The fan sled shall also allow inspection of the gas or electric heat exchangers. The fan sled shall have rubber dampers to isolate and minimize vibration. The 7 blade, welded construction impeller shall be dynamically balanced at the factory with hub; admissible vibration level less than 2,8 mm/s (0.11 in/s) in conformity with ANSI/AMCA 204. The fan sled shall include Inlet cone with measuring device for airflow measurement.
3. The packaged unit shall allow fan inlet differential pressure readings inside the control panel to measure supply fan CFM with an accuracy of +/-5%.
4. The unit controller shall allow fan speed settings for occupied and unoccupied modes. The unit controller shall allow fan speed settings for heating and cooling modes.
5. The fan system shall be made of galvanized steel. The impeller shall have RAL 5002 coating, directional arrows marketing. The fan sled shall allow up to 176°F (80°C) for the impeller and the motor shall allow ambient temperatures -4°F to 104°F (-20°C to 40°C). The impeller and motor shall be designed for continuous operation.
6. The ABB frequency drive shall be factory installed with line reactor, ECM Filter and all necessary wiring per UL standard. The drive shall have built in menu drive display with test, start-up, maintenance and diagnostic assistant. The drive shall be factory programmed for 30 second soft start. The drive shall have the following protection and alarms: single phase, over-voltage trip limit, under voltage trip limit, over temperature, microprocessor fault, motor stall protection, motor over temperature.
7. The unit shall meet the schedule performance. The unit control system shall have test and balance function to allow permanent setting of the airflow(s) as shown in the mechanical schedule.

I. Controls
1. The unit control panel section shall be laid out to provide separation of high and low voltage components per UL Standards. The primary control panel shall be hinged for easy access. Controls shall be factory configured for the design application with both the required hardware, operating parameters, and typical default control setpoints.
2. The controller is factory mounted on the unit and is pre-wired to the unit controls. The controller shall have visual (LED) status of power, running, and errors. LED indicators for transmit/receive for networks and for each of the 12 outputs. The controller shall have unit mounted display with two line 40 alpha/numeric character per line display providing full access to all commission variables, setpoints, alarms and diagnostic functions. The controller shall have BACnet (ARC156, MS/TP, and PTP) network communication available without the need for further programming or external devices.
3. The control system shall have the capability to communicate using LonWorks protocol. [Customer wall-mounted controls shall be available for providing [remote temperature adjustment] [on/off -auto control].
4. Each unit shall be equipped with an air-proving switch to ensure proper blower operation prior to enabling cooling and heating functions. Cooling controls shall include minimum “on/off” compressor time delays and anti-cycling program to prevent unnecessary wear of compressor.

5. Commissioning control variables shall include outdoor setpoints for heating and cooling sequencing based on outdoor drybulb, discharge or space temperature setpoints and low limit discharge air settings for freeze protection.
6. The alarm functionality shall include low temperature, compressor failure, sensor failure, smoke alarm, power failure, heating failure and supply fan failure. The failures shall protect the unit and displays a code at the unit's display and the optional wall mounted display.
7. The unit will have test and diagnostics routines for services and start-up. The control system shall be able to provide D21 neutral air and space temperature control per the sequence of operation shown.

J. Outdoor Air Section
1. Units shall be available with fully integrated factory installed 100% motorized outdoor air damper. The motorized damper shall be spring return for closure during unit shutdown or power interruption. The outsider air dampers shall be controlled occupied and unoccupied positions. Outdoor air inlet hood shall include 1" permanent filters. Units designed for 100% outside air intake only shall include an integrated transition section (without return air opening) designed specifically for 100% outside air introduction to allow uniform coil velocity and filter loading.

K. Filters
1. Filters shall mount integral within unit casing and be accessible through hinged access panel. Filters shall be 4" disposable pleated MERV13.

L. Full Perimeter Curbs
1. The curbs available from the manufacturer shall be designed to meet the National Roofing Contractors Association August 1985 guidelines for roof mounted installations. The roof curbs shall be 12 gauge zinc coated steel with a 2" x 6" nailer. Factory curb shall be required for systems requiring horizontal discharge or return air connection. The curb is to be shipped knocked down with assembly instructions. The curb shall incorporated energy recovery options.

M. Options and Accessories
1. Refer to equipment schedules on drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Roof Curbs:
1. Install curbs in complete accordance with the manufacturer's printed instructions, and as indicated.
2. Deliver roof curbs to construction contractor for installation.

B. Air Conditioners:
1. Install equipment on roof curbs in complete accordance with the manufacturers' printed instructions, and as indicated.
2. Provide all piping, electrical and ductwork connections to equipment through roof curb openings under units.

3.02 FIELD QUALITY CONTROL

A. Preliminary Requirements: Employ the services of a Company Field Advisor of the rooftop air conditioner manufacturer for the following:
1. Inspect air conditioner installations prior to start-up.
2. Supervise initial start-up of machine.
3. Instruction of Owner's Personnel.

4. Service.

B. Pre-Start-Up, Start-Up and Instruction: Upon completion of the installation of the air conditioner, to the satisfaction of the Company Field Advisor, start-up and preliminary testing shall be accomplished under the Company Field Advisor's supervision. When all necessary adjustments have been made and air conditioner is properly operating, the Company Field Advisor shall instruct Owner's Personnel in the operation and maintenance of the air conditioner and accessories.

END OF SECTION 237433

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. The variable capacity, heat pump air conditioning system shall consist of multiple evaporators, refrigerant pipe joints and headers, a two-pipe refrigeration distribution system using PID control, and an air-cooled condensing unit. The condensing unit shall be a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant. The condensing unit shall be capable of connection to an indoor evaporator capacity up to 200% of the condensing unit capacity. All zones shall each be capable of operating separately with individual temperature control.

B. The condensing unit shall be interconnected to indoor unit models in accordance with the manufacturer's recommendations. The indoor units shall be connected to the condensing unit utilizing manufacturer approved piping joints and headers to ensure correct refrigerant flow and balancing. T- style joints are not acceptable.

C. Operation of the system shall permit either cooling or heating of all of the indoor units simultaneously. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, an Intelligent Controller, an Intelligent Manager or a BMS interface.

D. An outdoor air shall be delivered to the system via an energy recovery ventilator. The energy recovery ventilator shall incorporate a high-efficiency paper, cross-flow heat exchanger core in order to provide both sensible and latent heat recovery.

1.02 SYSTEM DESCRIPTION

A. Advanced Zoning - A single system shall provide for up to 62 zones.

B. Autocharging - Each system shall have a refrigerant auto-charging function.

C. Oil Return Heating - Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.

D. Independent Control - Each indoor unit shall use a dedicated electronic expansion valve for independent control.

E. VFD Inverter Control - Each condensing unit shall use a high efficiency, variable speed “inverter” compressor coupled with inverter fan motors for superior part load performance.

F. Compressor capacity shall be modulated automatically to maintain constant suction and condensing pressures while varying the refrigerant volume for the needs of the cooling or heating loads.

G. Indoor units shall use PID to control superheat to deliver a comfortable room temperature condition and optimize efficiency.

H. Flexible Design
   1. Systems shall be capable of up to 540 ft. (640 ft. equivalent) of linear piping between the condensing unit and furthest located indoor unit.
   2. Systems shall be capable of up to 3,280 ft. total “one-way” piping in the piping network.
   3. Systems shall have a vertical (height) separation of up to 295 ft. between the condensing unit and the indoor units.
   4. Systems shall be capable of up to 295 ft. from the first branch point.

5. The condensing unit shall have the ability to connect an indoor unit evaporator capacity of up to 200% of the condensing unit capacity.
6. Systems shall be capable of 49 ft. between indoor units.
7. Condensing units shall be supported with a fan motor ESP up to 0.32” WG as standard to allow connection of discharge ductwork and to prevent discharge air short circuiting.

I. Simple Wiring - Systems shall use 16/18 AWG, 2 wire, multi-stranded, non-shielded and non-polarized daisy chain control wiring.

J. Advanced Diagnostics - Systems shall include a self diagnostic, auto-check function to detect a malfunction and display the type and location.

K. Each condensing unit shall incorporate contacts for electrical demand shedding.

L. Advanced Controls - Each system shall have at least one remote controller capable of controlling up to 16 indoor units.

M. Each system shall be capable of integrating with open protocol BACnet and LonWorks building management systems.

1.03 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 - Heating and Cooling Equipment, and shall bear the Listed Mark.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be rated in accordance with Air-conditioning Refrigeration Institute’s (ARI) Standard 210 and bear the ARI Certification label.

D. The system shall be manufactured in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

E. The condensing unit shall be factory charged with R410A refrigerant.

F. The energy recovery ventilator shall be certified in accordance with Air Conditioning, Heating, and Refrigeration Institute’s (AHRI) Standard 1060 and bear the AHRI Certified label.

G. The energy recovery heat exchanger core shall be tested in accordance with Underwriters Laboratories (UL) 723 and shall have a flame spread rating of not more than 25, and a smoke developed rating of not more than 50.

H. The energy recover system efficiency shall meet or exceed 65% thermal efficiency and 40% enthalpy recovery efficiency.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be stored and handled according to the manufacturer’s recommendations.

1.05 WARRANTY

A. Condensing Unit
1. The manufacturer shall warrant to the customer who is the original owner and user of the products specified above (“Customer”) that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from

defects in material or workmanship. This warranty shall apply to parts only and is limited in duration to one (1) year from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment. Customer must present proof of the original date of receipt and of installation of the Product in order to establish the effective date of this warranty. Otherwise the effective date will be deemed to be the date of manufacture plus sixty (60) days. Repaired or replacement parts shall be warranted for the balance of the warranty period applicable to the original part following the date on which the repaired or replacement part is provided to the Customer.

2. For its compressors only, the manufacturer shall provide the above warranty (which is applicable to parts only) for a seven (7) year period. This extended warranty for compressors shall be limited in duration to seven (7) years from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment, and applies to the compressor and compressor parts only. The effective date of this extended warranty shall be established as above.

B. Indoor Unit
   1. The units shall have a manufacturer's warranty for a period of one (1) year from date of installation. The units shall have a limited labor warranty for a period of one (1) year from date of installation. The compressors shall have a warranty of seven (7) years from date of installation. During the stated period, should any part fail due to defects in material and workmanship, it shall be repaired or replaced at the discretion of the manufacturer according to their terms and conditions. All warranty service work shall be performed by a manufacturer factory trained service professional.

C. Energy Recovery Unit
   1. The manufacturer shall warrant to the customer who is the original owner and user of the products specified above ("Customer") that under normal use and maintenance for comfort cooling and conditioning applications such products (the "Products") will be free from defects in material or workmanship. This warranty applies to parts only and is limited in duration to one (1) year from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) eighteen (18) months from the date of shipment. Customer must present proof of the original date of receipt and of installation of the Product in order to establish the effective date of this warranty. Otherwise the effective date will be deemed to be the date of manufacture plus sixty (60) days. Repaired or replacement parts are warranted for the balance of the warranty period applicable to the original part following the date on which the repaired or replacement part is provided to the Customer.
   2. For the core only, the manufacturer shall provide the above warranty for a six (6) year period. This extended warranty for the core is limited in duration to six (6) years from the earlier to occur of (a) the date of original installation, whether or not actual use begins on that date, or (b) twenty-four (24) months from the date of shipment. The effective date of this extended warranty shall be established as above.

D. System Installation Requirements
   1. The system must be installed by a factory trained contractor/dealer. The bidders shall be required to submit training certification proof with bid documents. The mechanical contractor's installation price shall be based on the systems installation requirements. The mechanical contractor bids with complete knowledge of the HVAC system requirements. Untrained contractors who wish to bid this project shall contact the manufacturer to arrange training prior to bid day.

1.06 SUBMITTALS

A. Submit manufacturer's product data including capacity of unit, electrical requirements, airflow, sound pressure data, indoor and outdoor unit measurements, weight, control schematics, and wiring diagrams.

PART 2 - PRODUCTS

2.01 DESIGN BASIS

A. The basis of design is Daikin AC. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein. In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.

2.02 CONDENSING UNIT

A. General: The condensing unit shall be designed specifically for use with a variable refrigerant volume system.
   1. The condensing unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Liquid and suction lines shall be individually insulated between the condensing and indoor units.
   3. The connection ratio of indoor units to condensing unit shall be permitted up to 200%.
   4. The condensing unit shall be able to support the connection of multiple indoor units.
   5. The system shall automatically restart operation after a power failure. System settings shall be saved in the event of a power loss without the need for reprogramming.
   6. The unit shall incorporate an auto-charging feature.
   7. The condensing unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
   8. The following safety devices shall be included on the condensing unit: high pressure sensor and switch, low pressure switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
   9. To ensure the liquid refrigerant does not flash when supplying to the various indoor units, the circuit shall be provided with a sub-cooling feature.
   10. Oil recovery cycle shall be automatic occurring 2 hours after start of operation and then every 8 hours of operation. Each system shall maintain continuous heating during oil return operation. Reverse cycle (cooling mode) oil return during heating operation shall not be permitted due to the potential reduction in space temperature.
   11. The condensing unit shall be capable of heating operation at 0°F dry bulb ambient temperature without additional low ambient controls or an auxiliary heat source.

B. Unit Cabinet:
   1. The condensing unit shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

C. Fan:
   1. The condensing unit shall consist of propeller type, direct-drive fan motor(s) that have multiple speed operation via a DC (digitally commutating) inverter.

2. The condensing unit fan motor shall have multiple speed operation of the DC (digitally commutating) inverter type.
3. The fan shall be a vertical discharge configuration.
4. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
5. The fan motor shall be provided with a fan guard to prevent contact with moving parts.
6. Night setback control of the fan motor for low noise operation by way of automatically limiting the maximum speed shall be a standard feature.

D. Condenser Coil:
1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure high efficiency performance.
3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube with N-shape internal grooves mechanically bonded on to aluminum fins to an e-Pass Design.
4. The fins shall be covered with an anti-corrosion acrylic resin and hydrophilic film type E1.
5. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.

E. Compressor:
1. The inverter scroll compressors shall be variable speed (PVM inverter) controlled and capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity (INV frequency or STD ON/OFF) shall be controlled to eliminate deviation from target value.
2. The inverter driven compressor in each condensing unit shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed scroll “G2-type” with a maximum speed of 7,980 rpm.
3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
4. The capacity control range shall be as low as 4% to 100%.
5. Each non-inverter compressor shall also be of the hermetically sealed scroll type.
6. Each compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
7. Oil separators shall be standard with the equipment together with an intelligent oil management system.
8. The compressor shall be spring mounted to avoid the transmission of vibration.
9. In the event of compressor failure in a system with multiple compressors, the remaining compressors shall continue to operate and provide heating or cooling as required at a proportionally reduced capacity. The microprocessor and associated controls shall be designed to specifically address this condition.
10. In the case of multiple condenser modules, conjoined operation hours of the compressors shall be balanced by means of the Duty Cycling Function, ensuring sequential starting of each module at each start/stop cycle, completion of oil return, completion of defrost or every 8 hours.

F. Electrical:
1. Refer to equipment schedules located on drawings for power requirements.

2. The control voltage between the indoor and condensing unit shall be 16VDC non-shielded, stranded 2 conductor cable.
3. The control wiring shall be a two-wire multiplex transmission system, making it possible to connect multiple indoor units to one condensing unit with one 2-cable wire, thus simplifying the wiring installation.
4. The control wiring lengths shall be as shown below.

G. Operating Range:
1. The operating range in cooling shall be 23°F DB ~ 122°F DB.
2. The operating range in heating shall be 0°F DB - 77°F DB / -4°F WB - 60°F WB.

2.03 ROUND FLOW CEILING CASSETTE INDOOR UNITS (3'X3')

A. General: Indoor unit shall be a round flow ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill. Unit to be connected to outdoor unit heat pump or heat recovery model. It shall be a round flow air distribution type, fresh white, impact resistant with a washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature.

B. Performance: Refer to equipment schedules on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The round flow supply air flow shall be adjustable to different airflow patterns to accommodate various installation configurations including corner installations.
5. Return air shall be through the concentric panel, which includes a resin net, mold resistant, antibacterial filter.
6. The indoor units shall be equipped with a condensate pan with antibacterial treatment and condensate pump. The condensate pump shall provide up to 33-1/2” of lift and have a built in safety shutoff and alarm.
7. The indoor units shall be equipped with a return air thermistor.
8. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
1. The cabinet shall be space saving and shall be located into the ceiling.
2. The unit shall consist of multiple auto-swing positions.
3. The airflow of the unit shall have the ability to shut down outlets with multiple patterns allowing for simpler installation in irregular spaces.
4. Fresh air intake shall be possible via an optional fresh air intake kit. Refer to equipment schedule on drawings for options selected.
5. A branch duct knockout shall exist for branch ducting of supply air.
6. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

7. High efficiency MERV 13 air filters shall be available for each model unit. Refer to equipment schedule on drawings for options selected.

E. Fan:
1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with three fan speeds available.
2. The airflow rate shall be available in three settings.
3. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings to allow operation with a MERV 13 filter as necessary.
4. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin and antibacterial treatment.
2. Optional high efficiency disposable MERV 13 filters shall be available.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 17 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A condensate pan with antibacterial treatment shall be located under the coil.
6. A condensate pump shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply will be required. Refer to equipment schedule on drawings for electrical requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.04 4-WAY CEILING CASSETTE INDOOR UNITS (2'X2')

A. General: The indoor unit shall be a ceiling cassette fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity equipped with an air panel grill. Unit to be connected to outdoor unit heat pump or heat recovery model. It shall be a four-way air distribution type, white, impact resistant with a washable decoration panel. The supply air shall be distributed via motorized louvers which can be horizontally and vertically adjusted from 0° to 90°. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. The unit shall be suitable for installation in a 24 inch x 24 inch ceiling grid.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
   1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
   3. Both refrigerant lines shall be insulated from the outdoor unit.
   4. The 4-way supply air flow shall be adjustable to 3-way and 2-way airflow to accommodate various installation configurations including corner installations.
   5. Return air shall be through the concentric panel, which includes a resin net mold resistant filter.
   6. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 21” of lift and have a built in safety shutoff and alarm.
   7. The indoor units shall be equipped with a return air thermistor.
   8. All electrical components shall be accessed through the decoration panel.
   9. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for electrical requirements.

D. Unit Cabinet:
   1. The cabinet shall be space saving and shall be located into the ceiling.
   2. The unit shall consist of multiple auto-swing positions.
   3. The airflow of the unit shall have the ability to shut down one or two sides allowing for simpler corner installation.
   4. Fresh air intake shall be possible by way of direct duct installation to the side of the indoor unit cabinet.
   5. A branch duct knockout shall exist for branch ducting supply air.
   6. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
   1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
   2. The airflow rate shall be available in high and low settings.
   3. The fan motor shall be thermally protected.

F. Filter:
   1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:
   1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
   2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
   3. The coil shall be a 2-row cross fin copper evaporator coil with 17 FPI design completely factory tested.
   4. The refrigerant connections shall be flare connections.
   5. A condensate pan shall be located under the coil.
   6. A condensate pump shall be located below the coil in the condensate pan with a built in safety alarm.

7. A thermistor will be located on the liquid and gas line.

H. Electrical:
   1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
   2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
   3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
   1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
   2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to schedule on drawings for options selected.

2.05 CONCEALED CEILING DUCTED INDOOR UNITS (MEDIUM STATIC)

A. General: The indoor unit shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, direct-drive DC (ECM) type fan with auto CFM adjustment at commissioning, for installation into the ceiling cavity. It shall be constructed of a galvanized steel casing. Unit to be connected to outdoor unit heat pump or heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. Included as standard equipment, a condensate drain pan and drain pump kit that pumps to 18-3/8” from the drain pipe opening.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
   1. The indoor unit shall be completely factory assembled and tested. Included in the unit shall be factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall be equipment with automatically adjusting external static pressure logic that is selectable during commissioning for adjustment of airflow.
   2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
   3. Both refrigerant lines shall be insulated from the outdoor unit.
   4. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 18-3/8” of lift from the center of the drain outlet and have a built in safety shutoff and alarm.
   5. The indoor units shall be equipped with a return air thermistor.
   6. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
   1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
   2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
   1. The fan shall be direct-drive DC (ECM) type fan, statically and dynamically balanced impeller with three fan speeds available.

2. The unit shall be equipment with automatically adjusting external static pressure logic selectable during commissioning.
3. The airflow rate shall be available in three settings.
4. The fan motor shall be thermally protected.
5. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A condensate pan shall be located under the coil.
6. A condensate pump shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

G. Electrical:
1. A separate power supply will be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.06 SLIM DUCT CONCEALED CEILING INDOOR UNITS

A. General: The indoor unit model shall be a Slim, built-in ceiling concealed fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation into the ceiling cavity. The unit shall be constructed of a galvanized steel casing. Unit to be connected to outdoor unit heat pump or heat recovery model. It shall be a horizontal discharge air with horizontal return air or bottom return air configuration. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. Included as standard equipment, a long-life filter that is mold resistant and a condensate drain pan and drain pump kit.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, condensate drain pump, condensate safety shutoff and alarm, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have adjustable external static pressure capabilities.

2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan and condensate pump. The condensate pump shall provide up to 23-5/8” of lift from the center of the drain outlet and have a built in safety shutoff and alarm.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.
8. Switch box shall be reached from the side or bottom for service and maintenance.

D. Unit Cabinet:
1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The airflow rate shall be available in high and low settings.
3. The fan motor shall be thermally protected.
4. The fan motor shall be equipped as standard with adjustable external static pressure (ESP) settings.
5. Fan motor external static pressure range for nominal airflow:

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2 or 3-row cross fin copper evaporator coil with 14 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A condensate pan shall be located under the coil.
6. A condensate pump with a 23-5/8” lift shall be located below the coil in the condensate pan with a built in safety alarm.
7. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.

2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.07 CEILING SUSPENDED CASSETTE INDOOR UNITS

A. General: The indoor unit shall be a ceiling suspended fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall or ceiling within a conditioned space. Unit shall have a finished white casing. Unit to be connected to outdoor unit heat pump and heat recovery model. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from the rear, top or left and right sides of the unit.
2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
1. The cabinet shall be affixed to a factory supplied wall/ceiling hanging brackets and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The airflow rate shall be available in high and low settings.
3. The fan motor shall be thermally protected.

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 15 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections.

5. A thermistor will be located on the liquid and gas line.
6. A condensate pan shall be located in the unit.

G. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.
3. The unit shall be compatible with a Daikin intelligent Touch advanced multi-zone controller or an intelligent Manager III customizable BMS. Consult with Daikin prior to applying controls.

2.08 WALL MOUNTED INDOOR UNITS

A. General: The indoor unit shall be a wall mounted fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. Unit shall have a finished white casing. Unit to be connected to outdoor unit heat pump or heat recovery model. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The front grille shall be easily removed for washing. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The drain pipe can be fitted to from either left or right sides.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.

2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be a direct-drive cross-flow fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The airflow rate shall be available in high and low settings.
3. The fan motor shall be thermally protected.

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 14 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A thermistor will be located on the liquid and gas line.
6. A condensate pan shall be located in the unit.

G. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.09 FLOOR CONSOLE INDOOR UNITS

A. General: The indoor unit shall be a floor or low wall mounted console fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation within a conditioned space. It shall have a top discharge air grill and resin net mold resistant filtered bottom return air. Unit shall have a finished ivory white casing. Unit to be connected to outdoor unit heat pump or heat recovery model. The cabinets can be mounted on the floor with refrigerant and condensate lines directed downward or affixed to the wall with horizontal refrigerant and condensate knockouts. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. A mold-resistant, resin net air filter shall be included as standard equipment.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops.

2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. Condensate draining shall be made via gravity or external condensate pump.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing fiberglass urethane foam insulation.

E. Fan:
1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The airflow rate shall be available in high and low settings.
3. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3-row cross fin copper evaporator coil with 17 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.10 FLOOR CONSOLE CONCEALED INDOOR UNITS

A. General: The indoor unit shall be a floor or wall mounted console fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation within a conditioned space. It shall have a top discharge air grill and filtered bottom return air. The unit shall have an unfinished casing. Unit to be connected to outdoor unit heat pump or heat

recovery model. The cabinets can be mounted on the floor with refrigerant and condensate lines directed downward or affixed to the wall with horizontal refrigerant and condensate knockouts. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature. A mold-resistant, resin net air filter shall be included as standard equipment.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops.
2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through a resin net mold resistant filter.
5. Condensate draining shall be made via gravity or external condensate pump.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit shall be separately powered. Refer to equipment schedule for power requirements.

D. Unit Cabinet:
1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing fiberglass urethane foam insulation.

E. Fan:
1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The airflow rate shall be available in high and low settings.
3. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a washable long-life filter with mildew proof resin.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3-row cross fin copper evaporator coil with 17 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).

3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.11 VERTICAL AIR HANDLING INDOOR UNITS

A. General: The indoor unit shall be a floor mounted vertical or horizontal right air handling unit, operable with refrigerant R-410A, equipped with an electronic expansion valve and direct-drive ECM type fan with auto CFM adjustment, for installation within a conditioned space. When installed in a vertical configuration it shall have top discharge air and bottom return air. When installed in a horizontal right configuration it shall have a horizontal discharge air and horizontal return air. The unit shall have a pre-painted heavy-gauge steel casing. Unit to be connected to outdoor unit heat pump or heat recovery model. A remote temperature sensor kit shall be provided for all indoor units not utilizing the thermistor in the remote controller. Computerized PID control shall be used to control superheat for temperature control. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit components shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, brazed connections, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through an optional or field supplied filter.
5. Condensate draining shall be made via gravity or external condensate pump.
6. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
1. The cabinet shall be constructed with sound absorbing, foil-faced insulation to control air leakage.
2. A field supplied secondary drain pan must be installed

E. Fan:
1. The fan shall be a direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The airflow rate shall be available in high setting.
3. The fan motor shall be thermally protected.

F. Filter:
1. The return air shall be filtered by means of a field supplied filter.

G. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.

2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 4-row cross fin copper evaporator coil with 15 fpi design completely factory tested.
4. The refrigerant connections shall be brazed connections.
5. A thermistor will be located on the liquid and gas line.

H. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

I. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule for options selected.

2.12 OUTSIDE AIR PROCESSING UNITS

A. General: The indoor unit shall be a built-in ceiling concealed fan coil unit, operable with refrigerant R-410A, equipped with an electronic expansion valve, for installation into the ceiling cavity. The unit shall be capable of introducing up to 100% outside air controlled to a fixed discharge air temperature. It shall be constructed of a galvanized steel casing. Unit to be connected to outdoor unit model heat pump and heat recovery model. It shall be a horizontal discharge air with horizontal return air configuration. All models feature a low height cabinet making them applicable to ceiling pockets that tend to be shallow. Computerized PID control shall be used to control superheat for temperature control.

B. Performance: Refer to equipment schedule on drawings.

C. Indoor Unit:
1. The indoor unit shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, self-diagnostics, auto-restart function, 3-minute fused time delay and test run switch.
2. Indoor unit and refrigerant pipes shall be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. The indoor units shall be equipped with a discharge air thermistor.
5. The indoor unit shall be separately powered. Refer to equipment schedule on drawings for power requirements.

D. Unit Cabinet:
1. The cabinet shall be located into the ceiling and ducted to the supply and return openings.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:
1. The fan shall be direct-drive Sirocco type fan, statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall be thermally protected.

3. Fan motor external static pressure for nominal airflow:

F. Coil:
1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 3 row cross fin copper evaporator coil with 13 fpi design completely factory tested.
4. The refrigerant connections shall be flare connections.
5. A thermistor will be located on the liquid and gas line.

G. Electrical:
1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet (total 6,560 feet).
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. The unit shall be compatible with interfacing with a BMS system via optional LonWorks or BACnet gateways. Refer to equipment schedule on drawings for options selected.

2.13 ENERGY RECOVERY VENTILATOR

A. General:
1. The energy recovery ventilator, incorporating a high-efficiency paper, cross-flow heat exchanger core in order to provide both sensible and latent heat recovery.

B. Unit Cabinet:
1. The cabinet shall be constructed of galvanized steel plate.
2. The unit shall be internally insulated with a self-extinguishing urethane foam.

C. Fans:
1. The fans shall be direct-drive, forward-curved centrifugal type with statically and dynamically balanced impellers with extra-high, high, and low fan speeds.
2. The air flow rate shall be available in extra-high, high, and low settings.
3. The fan motor shall be thermally protected.

D. Filter:
1. The supply and exhaust air streams shall be filtered prior to entering the heat exchanger core by means of a multi-directional fibrous fleece filter.

E. Heat Exchanger:
1. The heat exchanger element shall consist of a specially processed, nonflammable, HEP (high efficiency paper) heat exchanger designed to allow the exchange of both sensible and latent energy between the supply and exhaust airstreams. The core material shall be tested as specified in UL 723 and have a flame spread rating of not more than 25, and a smoke developed rating of not more than 50.

F. Electrical:

1. A separate power supply shall be required. Refer to equipment schedule on drawings for power requirements.
2. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

G. Control:
   1. The unit shall be capable of the following methods of control:
      a. Independent control - The unit shall be operable directly by a local remote controller.
      b. Interlocked control - The unit shall be operable in conjunction with a variable refrigerant volume (VRV) system by a local remote controller.
      c. Centralized control - The unit shall be operable by a centralized control without the need for a local remote controller to be connected.
   2. The unit shall be capable of the following modes of operation:
      a. Energy recovery
      b. Bypass ventilation - The unit shall be capable of bypass ventilation which diverts air flow around the heat exchanger core. No energy recovery is performed.
      c. Auto Mode - The unit shall be capable of automatically determining the need for performing energy recovery or bypassing the heat exchanger core based on the current fan coil operation mode and the current indoor and outdoor temperatures.
      d. Fresh-up Mode (supply) - The unit shall be capable of entering Fresh-up Supply operation in which the incoming supply air ratio is greater than the exhaust air ratio.
      e. Fresh-up Mode (exhaust) - The unit shall be capable of entering Fresh-up Exhaust operation which in the incoming supply air ratio is less than the exhaust air ratio.
      f. Night Time Free Cooling - The unit shall be capable of Night Time Free Cooling in which the unit will automatically energize to lower the space temperature based on the current outdoor temperature, the current indoor temperature, current set point, and the operating state of the indoor fan coils.

H. Installation
   1. The unit shall be capable of inverted installation if required by ductwork and access clearance requirements.
   2. The unit shall not require a condensate drain connection or condensate pan of any kind.

2.14 REFRIGERANT PIPING

A. The system shall be capable of refrigerant piping up to 540 actual feet or 620 equivalent feet from the condensing unit to the furthest indoor unit, a total combined liquid line length of 3,280 feet of piping between the condensing and indoor units with 295 feet maximum vertical difference, without any oil traps.

B. Piping joints and headers shall be used to ensure proper refrigerant balance and flow for optimum system capacity and performance. T style joints shall not be acceptable as this will negatively impact proper refrigerant balance and flow for optimum system capacity and performance.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all equipment, piping, and controls in accordance with manufacturer’s installation instructions.

B. Install refrigerant piping as per manufacturer’s instructions and specification.

C. Mount the outdoor condensing unit on a concrete equipment pad or equipment support rails.

D. Support the indoor unit as per the manufacturer's instructions.

E. Mount the controller. Coordinate exact location with the owner.

F. Install the drain line. Pitch drain line in the direction of flow.

G. Install new filter on indoor unit.

H. Clean all equipment after installation.

END OF SECTION 238126.12

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. The variable capacity, heat pump heat recovery air conditioning system shall be a Mitsubishi Electric CITY MULTI VRF (Variable Refrigerant Flow) zoning system.

B. The R2-Series system shall consist of a PURY outdoor unit, BC (Branch Circuit) Controller, multiple indoor units, and M-NET DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

C. The Y-Series system shall consist of PUHY outdoor unit, multiple indoor units, and M-NET DDC (Direct Digital Controls). The sum of connected capacity of all indoor air handlers shall range from 50% to 130% of outdoor rated capacity.

D. The S-Series system shall consist of the PUMY outdoor unit, multiple CITY MULTI indoor units, and M-NET DDC (Direct Digital Controls). The PUMY outdoor unit shall be a horizontal discharge, 208/230 volt, single-phase unit. Each CITY MULTI indoor unit or group of CITY MULTI indoor units shall be independently controlled.

1.02 QUALITY ASSURANCE

A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendation.

1.04 CONTROLS

A. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. System controls and control components shall be installed in accordance with the manufacturer's written installation instructions.

C. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

D. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

E. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

F. System shall be capable of email generation for remote alarm annunciation.

G. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in Mitsubishi controls system configuration and operation. The representative shall provide proof of certification for Mitsubishi CMCN Essentials Training and/or CMCN Hands-On Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

1.05 WARRANTY

A. The units shall be covered by the manufacturer's limited warranty for a period of one (1) year from date of installation.

B. If the systems are:
   1. designed by a certified CITY MULTI Diamond Designer,
   2. installed by a contractor that has successfully completed the Mitsubishi Electric three day service course, AND
   3. verified with a completed commissioning report submitted to and approved by the Mitsubishi Electric Service Department, then the units shall be covered by an extended manufacturer's limited warranty for a period of five (5) years from date of installation.

C. In addition the compressor shall have a manufacturer's limited warranty for a period of seven (7) years from date of installation.

D. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

E. This warranty shall not include labor.

F. Manufacturer shall have a minimum of twenty-nine years of HVAC experience in the U.S. market.

G. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

H. The CITY MULTI VRF system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

1.06 SUBMITTALS

A. Submit manufacturer's product data including capacity of unit, electrical requirements, airflow, sound pressure data, indoor and outdoor unit measurements, weight, control schematics, and wiring diagrams.

PART 2 - PRODUCTS

2.01 CEILING-CONCEALED DUCTED INDOOR UNIT

A. GENERAL:
   1. The PEFY-NMH(S)U (Alternate High Static Option) unit shall be a ceiling concealed ducted indoor fan coil that mounts above the ceiling with a fixed rear return and a horizontal discharge supply, and shall have a modulating linear expansion device. The PEFY-NMH(S)U shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY-NMH(S)U shall support individual control using M-NET DDC controllers. PEFY-NMH(S)U models shall feature external static pressure settings up 1.00 in. WG. Units shall have the ability to control supplemental heat via connector CN24 or CN4F and a 12 VDC output.

B. Indoor Unit:
   1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:
   1. The cabinet shall be ceiling-concealed, ducted.
   2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

D. Fan:
   1. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
   2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
   3. The indoor unit shall have a ducted air outlet system and ducted return air system.

E. Filter:
   1. Return air shall be filtered by a field-supplied filter.
   2. Optional rear return filter box with long-life filter shall available for all PEFY-NMH(S)U-E indoor units.

F. Coil:
   1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
   2. The tubing shall have inner grooves for high efficiency heat exchange.
   3. All tube joints shall be brazed with phos-copper or silver alloy.
   4. The coils shall be pressure tested at the factory.
   5. A condensate pan and drain shall be provided under the coil.
   6. The condensate shall be gravity drained from the fan coil.
   7. Both refrigerant lines to the PEFY indoor units shall be insulated.

G. Electrical:
   1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

H. Controls:
1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system. Please refer to Part 5 of this guide specification for details on controllers and other control options.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F - 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
6. Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
7. The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

2.02 OUTDOOR UNIT

A. General:

The Y-Series PUHY outdoor unit shall be specifically used with CITY MULTI VRF components. The PUHY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped, wired and run tested at the factory.
1. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kit shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.
2. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 65 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 55 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
3. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
4. Both refrigerant lines from the outdoor unit to indoor units shall be insulated.
5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
6. The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection.
7. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet (294 feet optional) and have a total refrigerant tubing length of 3280 feet. The greatest length is not to exceed 541 feet between the outdoor unit and the indoor units without the need for line size changes or traps.
8. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperature or cooling mode down to 23°F ambient temperature, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.

9. The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer supplied low ambient kit.
10. Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
11. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
12. Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
13. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.
14. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

B. Unit Cabinet:
1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models).

C. Fan:
1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan.
2. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
3. The fan motor shall be mounted for quiet operation.
4. The fan shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant
1. R410A refrigerant shall be required for PUHY-T/Y(S)KMU-A outdoor unit systems.
2. Polyester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

E. Coil:
1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:
1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
2. A crankcase heater(s) shall be factory mounted on the compressor(s).

3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 18%-4% of rated capacity, depending upon unit size
4. The compressor shall be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical:
1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.
2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

PART 3 - EXECUTION

3.01 GENERAL

A. Install all equipment, piping, and controls in accordance with manufacturer's installation instructions.

B. Install refrigerant piping as per manufacturer's instructions and specification.

C. Mount the outdoor condensing unit on a concrete equipment pad.

D. Support the indoor unit as per the manufacturer's instructions.

E. Mount the controller. Coordinate exact location with the owner.

F. Install the drain line. Pitch drain line in the direction of flow.

G. Install new filter on indoor unit.

H. Clean all equipment after installation.

END OF SECTION 238219

PART 1 - GENERAL

1.01 SYSTEM DESCRIPTION

A. The variable capacity, heat pump heat recovery air conditioning system shall be a Mitsubishi Electric CITY MULTI VRFZ (Variable Refrigerant Flow Zoning).

B. The R2-Series system shall consist of a PURY outdoor unit, BC (Branch Circuit) Controller, multiple indoor units, and M-NET DDC (Direct Digital Controls). Each indoor unit or group of indoor units shall be capable of operating in any mode independently of other indoor units or groups. System shall be capable of changing mode (cooling to heating, heating to cooling) with no interruption to system operation. To ensure owner comfort, each indoor unit or group of indoor units shall be independently controlled and capable of changing mode automatically when zone temperature strays 1.8 degrees F from set point for ten minutes. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of outdoor rated capacity.

C. The S-Series system shall consist of the PUMY outdoor unit, multiple CITY MULTI indoor units (- E models), and M-NET DDC (Direct Digital Controls). The PUMY outdoor unit shall be a horizontal discharge, 208/230 volt, single-phase unit. Each CITY MULTI indoor unit or group of CITY MULTI indoor units shall be independently controlled.

1.02 QUALITY ASSURANCE

A. The units shall be listed by Electrical Testing Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001 which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

D. All units must meet or exceed the 2010 Federal minimum efficiency requirements and the proposed ASHRAE 90.1 efficiency requirements for VRF systems. Efficiency shall be published in accordance with the DOE alternative test procedure, which is based on the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Standards 340/360, 1230 and ISO Standard 13256-1.

E. A full charge of R-410A for the condensing unit only shall be provided in the condensing unit.

1.03 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendation.

1.04 CONTROLS

A. The control system shall consist of a low voltage communication network of unitary built-in controllers with on-board communications and a web-based operator interface. A web controller with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. System controls and control components shall be installed in accordance with the manufacturer’s written installation instructions.

C. Furnish energy conservation features such as optimal start, night setback, request-based logic, and demand level adjustment of overall system capacity as specified in the sequence.

D. System shall provide direct and reverse-acting on and off algorithms based on an input condition or group conditions to cycle a binary output or multiple binary outputs.

E. Provide capability for future system expansion to include monitoring and use of occupant card access, lighting control and general equipment control.

F. Control system start-up shall be a required service to be completed by the manufacturer or a duly authorized, competent representative that has been factory trained in Mitsubishi controls system configuration and operation. The representative shall provide proof of certification for Mitsubishi CMCN Essentials Training and/or CMCN Hands-On Training indicating successful completion of no more than two (2) years prior to system installation. This certification shall be included as part of the equipment and/or controls submittals. This service shall be equipment and system count dependent and shall be a minimum of one (1) eight (8) hour period to be completed during normal working hours.

PART 2 - PRODUCTS

2.01 WARRANTY

A. The units shall be covered by the manufacturer’s limited warranty for a period of one (1) year from date of installation. If the systems are:
   1. designed by a certified CITY MULTI Diamond Designer,
   2. installed by a contractor that has successfully completed the Mitsubishi Electric three day service course, AND
   3. verified with a completed commissioning report submitted to and approved by the Mitsubishi Electric Service Department, then the units shall be covered by an extended manufacturer’s limited warranty for a period of five (5) years from date of installation.

B. In addition the compressor shall have a manufacturer’s limited warranty for a period of seven (7) years from date of installation.

C. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

D. This warranty shall not include labor.

E. Manufacturer shall have a minimum of twenty-nine years of HVAC experience in the U.S. market.

F. All manufacturer technical and service manuals must be readily available for download by any local contractor should emergency service be required. Registering and sign-in requirements which may delay emergency service reference are not allowed.

G. The CITY MULTI VRFZ system shall be installed by a contractor with extensive CITY MULTI install and service training. The mandatory contractor service and install training should be performed by the manufacturer.

PART 3 - PRODUCTS

3.01 R2-SERIES OUTDOOR UNIT

A. General: The R2-Series PURY outdoor unit shall be used specifically with CITY MULTI VRFZ components. The PURY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped and wired and run tested at the factory.
   1. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 64 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 53 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
   2. Both refrigerant lines from the outdoor unit to the BC (Branch Circuit) Controller (Single or Main) shall be insulated.
   3. There shall be no more than 3 branch circuit controllers connected to any one outdoor unit.
   4. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
   5. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
   6. The outdoor unit shall have a high pressure safety switch, over-current protection, crankcase heater and DC bus protection.
   7. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet and have total refrigerant tubing length of 1804-2625 feet. The greatest length is not to exceed 541 feet between outdoor unit and the indoor units without the need for line size changes or traps.
   8. The outdoor unit shall be capable of operating in heating mode down to -4?F ambient temperatures or cooling mode down to 23?F ambient temperatures, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
   9. The outdoor unit shall be capable of operating in cooling mode down to -10?F with optional manufacturer supplied low ambient kit.
   10. Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
   11. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
   12. Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
   13. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
   14. Unit must defrost all circuits simultaneously in order to resume full heating more quickly.
   15. Partial defrost which may extend “no or reduced heating” periods shall not be allowed.

B. Unit Cabinet:
   1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (-BS models)

C. Fan:
   1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.

2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
3. All fan motors shall be mounted for quiet operation.
4. All fans shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have vertical discharge airflow.

D. Refrigerant
1. R410A refrigerant shall be required for PURY-P-T/Y(S)KMU-A outdoor unit systems.
2. Polyester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

E. Coil:
1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

F. Compressor:
1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
2. A crankcase heater(s) shall be factory mounted on the compressor(s).
3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 19%-5% of rated capacity, depending upon unit size.
4. The compressor will be equipped with an internal thermal overload.
5. The compressor shall be mounted to avoid the transmission of vibration.
6. Field-installed oil equalization lines between modules are not allowed. Prior to bidding, manufacturers requiring equalization must submit oil line sizing calculations specific to each system and module placement for this project.

G. Controls:
1. The outdoor unit shall have the capability of up to 8 levels of demand control for each refrigerant system

H. Electrical:
1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.
2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187- 228 volts (208V/60Hz), 207-253V (230V/60Hz).
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.02 BRANCH CIRCUIT (BC) CONTROLLERS FOR R2-SERIES SYSTEMS

A. General
1. The BC (Branch Circuit) Controllers shall include multiple branches to allow simultaneous heating and cooling by allowing either hot gas refrigerant to flow to indoor unit(s) for

heating or subcooled liquid refrigerant to flow to indoor unit(s) for cooling. Refrigerant used for cooling must always be subcooled for optimal indoor unit LEV performance; alternate branch devices with no subcooling risk bubbles in liquid supplied to LEV and are not allowed.

2. The BC (Branch Circuit) Controllers shall be specifically used with R410A R2-Series systems. These units shall be equipped with a circuit board that interfaces to the M-NET controls system and shall perform all functions necessary for operation. The unit shall have a galvanized steel finish. The BC Controller shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors, with access and service clearance provided for each controller. The sum of connected capacity of all indoor air handlers shall range from 50% to 150% of rated capacity.

B. BC Unit Cabinet:
   1. The casing shall be fabricated of galvanized steel.
   2. Each cabinet shall house a liquid-gas separator and multiple refrigeration control valves.
   3. The unit shall house two tube-in-tube heat exchangers.

C. Refrigerant
   1. R410A refrigerant shall be required.

D. Refrigerant valves:
   1. The unit shall be furnished with multiple branch circuits which can individually accommodate up to 54,000 BTUH and up to three indoor units. Branches may be twinned to allow more than 54,000 BTUH.
   2. Each branch shall have multiple two-position valves to control refrigerant flow.
   3. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.
   4. Linear electronic expansion valves shall be used to control the variable refrigerant flow.

E. Integral Drain Pan:
   1. An Integral drain pan and drain shall be provided

F. Electrical:
   1. The unit electrical power shall be 208/230 volts, 1 phase, 60 Hertz. Provide with unit mounted disconnect switch.
   2. The unit shall be capable of satisfactory operation within voltage limits of 187-228 (208V/60Hz) or 207-253 (230/60Hz).
   3. The BC Controller shall be controlled by integral microprocessors
   4. The control circuit between the indoor units and outdoor units shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

3.03 S-SERIES OUTDOOR UNIT

A. General: The PUMY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
   1. The sum of connected capacity of all CITY MULTI indoor units shall range from 50% to 130% of outdoor rated capacity.
   2. Outdoor unit shall have a sound rating no higher than 52 dB(A).
   3. Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated.
   4. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
   5. The outdoor unit shall have a high pressure safety switch, low pressure safety switch and over-current protection and DC bus protection.

6. The outdoor unit shall have the ability to operate with a maximum height difference of 98 feet and have a total refrigerant tubing length of 393 feet. The greatest length is not to exceed 262 feet between the outdoor unit and the CITY MULTI indoor units and shall not require line size changes nor traps.
7. The outdoor unit shall have rated performance for heat operation at 0°F ambient temperature without additional low ambient controls.
8. The outdoor unit shall be capable of cooling operation down to 23oF outdoor ambient without additional low ambient controls.
9. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.

B. Unit Cabinet:
1. The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan:
1. The unit shall be furnished with two direct drive, variable speed motors.
2. The fans will be forward curved type blades for quiet operation.
3. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
4. The fan motor shall be mounted for quiet operation.
5. The fan shall be provided with a raised guard to prevent contact with moving parts.
6. The outdoor unit shall have horizontal discharge airflow.

D. Refrigerant
1. R410A refrigerant shall be required for PUMY-P-NHMU outdoor unit systems.

E. Coil:
1. The outdoor coil shall be of nonferrous construction with lanced or corrugated fins on copper tubing.
2. The coil fins will have a factory applied corrosion resistant blue-fin finish.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.

F. Compressor:
1. The compressor shall be a single high performance, inverter driven, modulating capacity scroll compressor.
2. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable down to 33% of rated capacity for the PUMY-P36NHMU (- BS) and 25% for the PUMY-P48NHMU (-BS).
3. The compressor shall be equipped with an internal thermal overload.
4. The compressor shall be mounted to avoid the transmission of vibration.

G. Electrical:
1. The outdoor unit electrical power shall be 208/230 volts, 1-phase, 60 hertz. Provide with unit mounted disconnect switch.
2. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)
3. The outdoor unit shall be controlled by integral microprocessors.
4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair, non-polar shielded cable to provide total integration of the system.

3.04 PLFY-P**NCMU-ER4 (4-WAY CEILING-RECESSED CASSETTE WITH GRILLE) INDOOR UNIT

A. General:
   1. The PLFY-P**NCMU-ER4 shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. Unit Cabinet:
   1. The cabinet shall be a compact 22-7/16” wide x 22-7/16” deep so it will fit within a standard 24” square suspended ceiling grid.
   2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
   3. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.

C. Fan:
   1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
   2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
   3. The indoor fan shall consist of three (3) speeds, Low, Mid, and High.
   4. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
   5. The auto air swing vanes shall be capable of automatically swinging up and down for uniform air distribution.

D. Filter:
   1. Return air shall be filtered by means of a long-life washable filter.

E. Coil:
   1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
   2. The tubing shall have inner grooves for high efficiency heat exchange.
   3. All tube joints shall be brazed with phos-copper or silver alloy.
   4. The coils shall be pressure tested at the factory.
   5. A condensate pan and drain shall be provided under the coil.
   6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 19-3/4” inches above the condensate pan.
   7. Both refrigerant lines to the PLFY indoor units shall be insulated.

F. Electrical:
   1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
   2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

G. Controls:
   1. This unit shall use controls provided by Mitsubishi Electric to perform functions necessary to operate the system.
   2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
   3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F - 9.0°F adjustable deadband from set point.

4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
6. Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery.
7. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
8. The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

3.05 PEFY-NMAU (CEILING-CONCEALED DUCTED) INDOOR UNIT

A. General:
   1. The PEFY shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling with a 2-position, field adjustable return and a fixed horizontal discharge supply and shall have a modulating linear expansion device. The PEFY shall be used with the R2-Series outdoor unit and BC Controller, Y-Series outdoor unit, or S-Series outdoor unit. The PEFY shall support individual control using M-NET DDC controllers.

B. Indoor Unit:
   1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

C. Unit Cabinet:
   1. The unit shall be, ceiling-concealed, ducted.
   2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

D. Fan:

E. PEFY-NMAU models shall feature external static pressure settings from 0.14 to 0.60 in.
   1. WG.
   2. The indoor unit fan shall be an assembly with one or two Sirocco fan(s) direct driven by a single motor.
   3. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
   4. The indoor fan shall consist of three (3) speeds, High, Mid, and Low plus the Auto-Fan function
   5. The indoor unit shall have a ducted air outlet system and ducted return air system.

F. Filter:
   1. Return air shall be filtered by means of a standard factory installed return air filter.
   2. Optional return filter box (rear or bottom placement) with high-efficiency filter shall be available for all PEFY indoor units.

G. Coil:
   1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
   2. The tubing shall have inner grooves for high efficiency heat exchange.
   3. All tube joints shall be brazed with phos-copper or silver alloy.
   4. The coils shall be pressure tested at the factory.
   5. A condensate pan and drain shall be provided under the coil.

6. The condensate shall be gravity drained from the fan coil.
7. Both refrigerant lines to the PEFY indoor units shall be insulated.

H. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz).

I. Controls:
1. This unit shall use controls provided by Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system. Please refer to Part 5 of this guide specification for details on controllers and other control options.
2. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
3. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F - 9.0°F adjustable deadband from set point.
4. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
5. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.
6. Manufacturer to provide drain pan level sensor powered by a 20-year life lithium battery.
7. Sensor shall require no external power for operation and shall have an audible indication of low battery condition.
8. The drain pan sensor shall provide protection against drain pan overflow by sensing a high condensate level in the drain pan. Should this occur the control shuts down the indoor unit before an overflow can occur. A thermistor error code will be produced should the sensor activate indicating a fault which must be resolved before the unit re-starts.

3.06 HEAT PUMP VRF OUTDOOR CONDENSING UNIT

A. Acceptable Manufacturers: Mitsubishi or approved equal

B. General:
1. The Y-Series PUHY outdoor unit shall be specifically used with CITY MULTI VRF components. The PUHY outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. Each outdoor unit module shall be completely factory assembled, piped, wired and run tested at the factory.
    a. The model nomenclature and unit requirements are shown below. All units requiring a factory supplied twinning kit shall be piped together in the field, without the need for equalizing line(s). If an alternate manufacturer is selected, any additional material, cost, and labor to install additional lines shall be incurred by the contractor.

OUTDOOR UNIT MODEL NOMENCLATURE		
208/230 Volt		Twinning Kit
Model Number	Units	
PUHY-P72TKMU	(1) PUHY-P72TKMU	None
PUHY-P96TKMU	(1) PUHY-P96TKMU	None
PUHY-P120TKMU	(1) PUHY-P120TKMU	None
PUHY-P144TKMU	(1) PUHY-P144TKMU	None
PUHY-P168TSKMU	(1) PUHY-P96TKMU (1) PUHY-P72TKMU	CMY-Y100CBK3
PUHY-P192TSKMU	(1) PUHY-P72TKMU (1) PUHY-P120TKMU	CMY-Y100CBK3
PUHY-P216TSKMU	(1) PUHY-P96TKMU (1) PUHY-P120TKMU	CMY-Y100CBK3
PUHY-P240TSKMU	(2) PUHY-P120TKMU	CMY-Y100CBK3
PUHY-P264TSKMU	(2) PUHY-P72TKMU (1) PUHY-P120TKMU	CMY-Y300CBK2
PUHY-P288TSKMU	(1) PUHY-P72TKMU (1) PUHY-P96TKMU (1) PUHY-P120TKMU	CMY-Y300CBK2
PUHY-P312TSKMU	(1) PUHY-P72TKMU (2) PUHY-P120TKMU	CMY-Y300CBK2
PUHY-P336TSKMU	(1) PUHY-P96TKMU (2) PUHY-P120TKMU	CMY-Y300CBK2
PUHY-P360TSKMU	(3) PUHY-P120TKMU	CMY-Y300CBK2

b. Outdoor unit shall have a sound rating no higher than 60 dB(A) individually or 65 dB(A) twinned. Units shall have a sound rating no higher than 50 dB(A) individually or 55 dB(A) twinned while in night mode operation. If an alternate manufacturer is selected, any additional material, cost, and labor to meet published sound levels shall be incurred by the contractor.
c. Outdoor unit shall be able to connect to up to 50 indoor units depending upon model.
d. Both refrigerant lines from the outdoor unit to indoor units shall be insulated.
e. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
f. The outdoor unit shall have a high pressure safety switch, over-current protection and DC bus protection.
g. The outdoor unit shall have the ability to operate with a maximum height difference of 164 feet (294 feet optional) and have a total refrigerant tubing length of 3280 feet. The greatest length is not to exceed 541 feet between the outdoor unit and the indoor units without the need for line size changes or traps.
h. The outdoor unit shall be capable of operating in heating mode down to -4°F ambient temperature or cooling mode down to 23°F ambient temperature, without additional low ambient controls. If an alternate manufacturer is selected, any additional material, cost, and labor to meet low ambient operating condition and performance shall be incurred by the contractor.
i. The outdoor unit shall be capable of operating in cooling mode down to -10°F with optional manufacturer supplied low ambient kit.
j. Manufacturer supplied low ambient kit shall be provided with predesigned control box rated for outdoor installation and capable of controlling kit operation automatically in all outdoor unit operation modes.
k. Manufacturer supplied low ambient kit shall be listed by Electrical Laboratories (ETL) and bear the ETL label.
l. Manufacturer supplied low ambient kit shall be factory tested in low ambient temperature chamber to ensure operation. Factory performance testing data shall be available when requested.
m. The outdoor unit shall be provided with a manufacturer supplied 20 gauge hot dipped galvanized snow /hail guard. The snow/hail guard protects the outdoor coil surfaces from hail damage and snow build-up in severe climates.
n. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
o. Equipment must be labeled “Assembled in USA” on equipment nameplate. Manufacturer must provide documentation from U.S. Customs and Border Protection indicating the equipment is a product of the U.S.

C. Unit Cabinet:
   1. The casing(s) shall be fabricated of galvanized steel, bonderized and finished. Units cabinets shall be able to withstand 960 hours per ASTM B117 criteria for seacoast protected models (–BS models).

D. Fan:
   1. Each outdoor unit module shall be furnished with one direct drive, variable speed propeller type fan.
   2. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed. The fan shall be factory set for operation under 0 in. WG external static pressure, but capable of normal operation under a maximum of 0.24 in. WG external static pressure via dipswitch.
   3. The fan motor shall be mounted for quiet operation.
   4. The fan shall be provided with a raised guard to prevent contact with moving parts.
   5. The outdoor unit shall have vertical discharge airflow.

E. Refrigerant
   1. R410A refrigerant shall be required for PUHY-T/Y(S)KMU-A outdoor unit systems.
   2. Polyolester (POE) oil shall be required. Prior to bidding, manufacturers using alternate oil types shall submit material safety data sheets (MSDS) and comparison of hygroscopic properties for alternate oil with list of local suppliers stocking alternate oil for approval at least two weeks prior to bidding.

F. Coil:
   1. The outdoor coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
   2. The coil fins shall have a factory applied corrosion resistant blue-fin finish.
   3. The coil shall be protected with an integral metal guard.
   4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
   5. The outdoor coil shall include 4 circuits with two position valves for each circuit, except for the last stage.

G. Compressor:
   1. Each outdoor unit module shall be equipped with one inverter driven scroll hermetic compressor. Non inverter-driven compressors, which cause inrush current (demand charges) and require larger wire sizing, shall not be allowed.
   2. A crankcase heater(s) shall be factory mounted on the compressor(s).
   3. The outdoor unit compressor shall have an inverter to modulate capacity. The capacity shall be completely variable with a turndown of 18%-4% of rated capacity, depending upon unit size
   4. The compressor shall be equipped with an internal thermal overload.
   5. The compressor shall be mounted to avoid the transmission of vibration.

H. Electrical:
   1. The outdoor unit electrical power shall be 208/230 volts, 3-phase, 60 hertz.
   2. The outdoor unit shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz), 207-253V (230V/60Hz).
   3. The outdoor unit shall be controlled by integral microprocessors.
   4. The control circuit between the indoor units, BC Controller and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair shielded cable to provide total integration of the system.

PART 4 - CONTROLS

4.01 OVERVIEW

A. General:
1. The CITY MULTI Controls Network (CMCN) shall be capable of supporting remote controllers, centralized controllers, an integrated web based interface, graphical user workstation, and system integration to Building Management Systems via BACnet® and LonWorks®.

4.02 ELECTRICAL CHARACTERISTICS

A. General:
1. The CMCN shall operate at 24VDC. Controller power and communications shall be via a common non-polar communications bus.

B. Wiring:
1. Control wiring shall be installed in a daisy chain configuration from indoor unit to ME remote controller to indoor unit, to the BC controller (main and subs, if applicable) and to the outdoor unit. Control wiring to remote controllers shall be run from the indoor unit terminal block to the controller associated with that unit.
2. Control wiring for centralized controllers shall be installed in a daisy chain configuration from outdoor unit to outdoor unit, to the system controllers (centralized controllers and/or integrated web based interface), to the power supply.
3. Provide one wall mounted Simple MA remote controller for each indoor unit. Control wiring for the remote controllers shall be from the remote controller to the first associated indoor unit (TB-15) then to the remaining associated indoor units (TB-15) in a daisy chain configuration.
4. The AG-150, GB-50ADA, GB-24 centralized controller shall be capable of being networked with other AG-150, GB-50ADA and GB-24 centralized controllers for centralized control.

C. Wiring type:
1. Wiring shall be 2-conductor (16 AWG), twisted, stranded, shielded wire as defined by the Diamond System Builder output.
2. Network wiring shall be CAT-5e with RJ-45 connection.

4.03 CITY MULTI CONTROLS NETWORK

A. The CITY MULTI Controls Network (CMCN) consists of remote controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The CITY MULTI Controls Network shall support operation monitoring, scheduling, error email distribution, personal web browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks® or BACnet® interfaces.
1. CMCN System Configuration CMCN: Remote ControllersRCe Backlit Simple MA Remote Controller (PAC-YT53CRAU)
2. The Backlit Simple MA Remote Controller (PAC-YT53CRAU) shall be capable of controlling up to 16 indoor units (defined as 1 group). The Backlit Simple MA Remote Controller shall be compact in size, approximately 3” x 5” and have limited user functionality. The Backlit Simple MA supports temperature display selection of Fahrenheit or Celsius. The Backlit Simple MA Remote Controller shall allow the user to change on/off, mode (cool, heat, auto (R2/WR2-Series only), dry, and fan), temperature setting, and fan speed setting and airflow direction. The Backlit Simple MA Remote Controller shall be able to limit the set temperature range from the Backlit Simple MA. The Backlit Simple MA Remote controller shall be capable of night setback control with upper and lower set

temperature settings. The room temperature shall be sensed at either the Backlit Simple MA Remote Controller or the Indoor Unit dependent on the indoor unit dipswitch setting. The Backlit Simple MA Remote Controller shall display a four-digit error code in the event of system abnormality/error.

3. The Backlit Simple MA Remote Controller shall only be used in same group with Deluxe MA Remote Controllers (PAR-21MAAU), Wireless MA Remote Controllers (PAR-FL32MA-E / PAR-FA32MA-E), or with other Backlit Simple MA Remote Controllers (PAC-YT53CRAU), with up to two remote controllers per group.
4. The Backlit Simple MA Remote Controller shall be capable of controlling the fan speed of an interlocked LOSSNAY to high/low/stop.
5. The Backlit Simple MA Remote Controller shall require no addressing. The Backlit Simple MA Remote Controller shall connect using two-wire, stranded, non-polar control wire to TB15 connection terminal on the indoor unit. The Simple MA Remote Controller shall require cross-over wiring for grouping across indoor units.

PAC-YT53CRAU (BACKLIT SIMPLE MA REMOTE CONTROLLER)			
ITEM	**DESCRIPTION**	**OPERATION**	**DISPLAY**
ON/OFF	RUN AND STOP OPERATION FOR A SINGLE GROUP	EACH GROUP	EACH GROUP
OPERATION MODE	SWITCHES BETWEEN COOL/DRYING/AUTO/FAN/HEAT/SETBACK. OPERATION MODES VARY DEPENDING ON THE AIR CONDITIONER UNIT. AUTO MODE IS IN THE R2/WR2-SERIES ONLY.	EACH GROUP	EACH GROUP
TEMPERATURE SETTING	SETS THE TEMPERATURE FROM 40°F - 95°F DEPENDING ON OPERATION MODE AND INDOOR UNIT.	EACH GROUP	EACH GROUP
FAN SPEED SETTING	HI/MID-2/MID-1/LOW/AUTO AVAILABLE FAN SPEED SETTINGS DEPENDING ON INDOOR UNIT.	EACH GROUP	EACH GROUP
AIR FLOW DIRECTION SETTING	AIR FLOW DIRECTION ANGLES (4 OR 5 ANGLE SWING) AUTO LOUVER ON/OFF AIR FLOW DIRECTION SETTINGS VARY DEPENDING ON THE INDOOR UNIT MODEL.	EACH GROUP	EACH GROUP
TIMER OPERATION	NOT AVAILABLE	N/A	N/A
PERMIT / PROHIBIT LOCAL OPERATION	INDIVIDUALLY PROHIBIT OPERATION OF EACH LOCAL REMOTE CONTROL FUNCTION (START/STOP, CHANGE OPERATION MODE, SET TEMPERATURE, RESET FILTER). *1: CENTRALLY CONTROLLED IS DISPLAYED ON THE REMOTE CONTROLLER FOR PROHIBITED FUNCTIONS.	N/A	EACH GROUP *1
DISPLAY INDOOR UNIT INTAKE TEMP	MEASURES AND DISPLAYS THE INTAKE TEMPERATURE OF THE INDOOR UNIT WHEN THE INDOOR UNIT IS OPERATING.	N/A	EACH GROUP
DISPLAY BACKLIGHT	PRESSING THE BUTTON LIGHTS UP A BACKLIGHT. THE LIGHT AUTOMATICALLY TURNS OFF AFTER A CERTAIN PERIOD OF TIME. (THE BRIGHTNESS SETTINGS CAN BE SELECTED FROM BRIGHT, DARK, AND LIGHT OFF.)	N/A	EACH UNIT
ERROR	WHEN AN ERROR IS CURRENTLY OCCURRING ON AN AIR CONDITIONER UNIT, THE AFFLICTED UNIT AND THE ERROR CODE ARE DISPLAYED	N/A	EACH UNIT

TEST RUN	OPERATES AIR CONDITIONER UNITS IN TEST RUN MODE. *2 THE DISPLAY FOR TEST RUN MODE WILL BE THE SAME AS FOR NORMAL START/STOP (DOES NOT DISPLAY “TEST RUN”).	EACH GROUP	EACH GROUP *2
VENTILATION EQUIPMENT	UP TO 16 INDOOR UNITS CAN BE CONNECTED TO AN INTERLOCKED SYSTEM THAT HAS ONE LOSSNAY UNIT.	EACH GROUP	N/A
SET TEMPERATURE RANGE LIMIT	SET TEMPERATURE RANGE LIMIT FOR COOLING, HEATING, OR AUTO MODE.	EACH GROUP	EACH GROUP
PROHIBITION/ PERMISSION OF SPECIFIED	BY THE SETTING FROM SYSTEM CONTROLLER, THE OPERATION FOR THE FOLLOWING MODES IS PROHIBITED.	N/A	EACH GROUP

PAC-YT53CRAU (BACKLIT SIMPLE MA REMOTE CONTROLLER)			
ITEM	**DESCRIPTION**	**OPERATION**	**DISPLAY**
MODE	AT COOLING PROHIBITED : COOL, DRY, AUTO, AT HEATING PROHIBITED : HEAT, AUTO, AT COOLING-HEATING PROHIBITED : COOL, HEAT, DRY, AUTO		

5.01 CMCN: SYSTEM INTEGRATION

A. The CMCN shall be capable of supporting integration with Building Management Systems (BMS).

B. BAC-HD150: BACnet® Interface

C. The Mitsubishi Electric Cooling & Heating BACnet® interface, BAC-HD150, shall be compliant with BACnet® Protocol (ANSI/ASHRAE 135-2004) and be Certified by the (BTL) BACnet® Testing Laboratories. The BACnet® interface shall support BACnet Broadcast Management (BBMD). The BACnet® interface shall support a maximum of 50 indoor units. Operation and monitoring points include, but are not limited to, on/off, operation mode, fan speed, prohibit remote controller, filter sign reset, alarm state, error code, and error address. Power Supply (PAC-SC51KUA)

D. The power supply shall supply 24VDC (TB 3) for the AG-150 centralized controller and 24VDC (TB 2) voltage for the central control transmission.

END OF SECTION 238220

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Section 232000: Pipe, Valves, and Fittings.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog sheets, brochures, performance charts, standard finish chart, specifications and installation instructions for each item specified.
   2. Schedule: Itemize pipe or tube size and material, fin size and material, fin thickness, fin spacing per linear foot, actual finned length of each element, number of rows of element and rating in Btuh per linear foot of finned element (single or double row) and location of installation (room or space number).

1.03 PRODUCT DELIVERY

A. Deliver equipment in original shipping containers, properly labeled as to type, size and finish.

1.04 MAINTENANCE

A. Special Tools: One tool for each type and size vandal resistant fastener.

PART 2 - PRODUCTS

2.01 - HOT WATER CONVECTORS

A. Cover Assembly
   1. Furnish and install 350 Series model 351-14 baseboard cover assembly as manufactured by Slant/Fin Corp., consisting of one-piece, back and top panel, and one-piece front panel, formed of cold rolled steel. Bottom and top edges of back panel shall be formed to provide channels along entire length, to receive full-height support brackets. Brackets shall be die-formed of electro galvanized cold rolled steel, for rigid bracing and spring locking. Slide-action expansion cradles, formed of polypropylene, shall be inserted between heating element and support bracket. Cradles shall protect element bottom and sides from contact with brackets or cover, confining element to free lateral expansion for noiseless operation. All cover components with a 19-gauge front cover shall be painted in Nu-White thermosetting polyester enamel and all cover components with a 16-gauge front cover shall have a galvanized finish.

B. H-1 Element
   1. Furnish and install H-1 baseboard heating element as manufactured by Slant/Fin Corp. consisting of 3/4" nominal copper tubing, with 3" x 3-1/4" x .024" aluminum fins, spaced 48 per linear foot. The tubing shall not be weakened by expansion in process of manufacture, but shall be forced through undersized fin holes to obtain a force-fit mechanical bond. A flange with four teeth shall be formed on each fin to increase thermal contact and to space and lock the fins uniformly in place. One end of each element tube shall be expanded to receive the unexpanded end of another, without couplings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions unless otherwise shown or specified.

B. Secure convector radiator enclosures to masonry wall construction with expansion shields and bolts, of size in number and on centers as recommended by the manufacturer.

C. Install convector with air vents, isolation valves, and a balancing valve.

D. Install access panels for each control, shutoff, and balancing valve installed in enclosure.

END OF SECTION 238236

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavation and backfill for electrical work.

B. Demolition of existing electrical systems.

C. Primary power wiring and distribution system.

D. Secondary power wiring and distribution system.

E. Lighting, including lamps.

F. Wiring devices.

G. Distribution panels and switches.

H. Switchboard

I. Fire Alarm System

1.02 RELATED WORK

A. Foundations and pads required for equipment furnished under this division of specifications.

B. Field painting, except such painting as is required to maintain shop coat painting and factory finish painting.

C. Flashing and sealing of conduits through outside walls.

D. Cutting and patching for electrical work, except for errors and omissions under this Division.

1.03 QUALITY ASSURANCE

A. It is understood that the rights and benefits given the Owner by the guarantees found in the technical specifications are in addition to and not in derogation of any rights or benefits found in the special and general provisions of the contract.

B. Electrical equipment provided under this Division shall be turned over in operating condition. Instruction on further operation and maintenance shall be included in the operating and maintenance instructions.

1.04 REFERENCES

A. Perform work in accordance with standards listed below. Where these specifications are more stringent, they take precedence. In case of conflict, obtain a decision from the Engineer.
   1. NFPA-70: National Electrical Code
   2. NFPA-101: Life Safety Code
   3. New York State Energy Code
   4. New York State Building Code
   5. Applicable New York State Administrative Code
   6. Applicable Town Ordinances.
   7. Electric utility rules and regulations.
   8. MPS: New York State Education Department Manual of Planning Standards
   9. 155: 8 NYCRR 155 Regulations of the Commissioner of Education

10. UCS: Uniform Code Supplement
11. IBC: International Building Code
12. IFC: International Fire Code
13. IMC: International Mechanical Code
14. IPC: International Plumbing Code
15. IGC: International Fuel gas Code
16. IEBC: International Existing Building Code
17. ECCC: Supplement to the New York State Energy Conservation Construction Code

1.05 PERMITS AND FEES

A. The Contractor shall obtain and pay for all permits, construction charges, fees, licenses, certificates, inspections and other use charges required in connection with the work.

B. Such permits include, but are not limited to:
   1. Transportation and disposal of debris.
   2. Temporary Electrical Services and Permanent Electrical Service.
   3. Electrical Inspectors, Inc., or a pre-approved electrical inspection agency.
   4. Road opening permits.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. All materials and equipment used in carrying out these specifications shall have UL listing and label. Specifications and drawings indicate name, type, or catalog numbers of materials and equipment to be used as standards. Proposals shall be based on these standards. Contractor may use materials and equipment equivalent to those specified, subject to Engineer's approval.

PART 3 - EXECUTION

3.01 COORDINATION

A. Carefully examine specifications, drawings and project site to be thoroughly familiar with items which require electrical connections and coordination. Electrical drawings are diagrammatic and shall not be scaled for exact sizes.

B. Notify other Contractors of any deviations or special conditions necessary for the installation of work. Interferences between work of various contractors to be resolved prior to installation. Work installed not in compliance with specifications and drawings and without properly checking and coordinating as specified above shall, if necessary, be removed and properly reinstalled without additional cost to the Owner. Engineer to be mediating authority in all disputes arising on project.

C. Equipment shall be installed in accordance with manufacturer's recommendation. Where conflicts occur between contract documents and these recommendations, a clarification shall be requested of the Engineer for decision before preceding with such work.

D. Insofar as it is possible to determine in advance, advise masonry tradesmen to leave proper chases and openings. Place all outlets, anchors, sleeves, and supports prior to pouring concrete or installation of masonry work. Should the Contractor neglect doing this, any cutting and/or patching required to be done is at this Contractor's expense.

E. FIRE ALARM – For any facilities that utilize an existing fire alarm system, the contractor shall coordinate with the owner and fire alarm monitoring company prior to removing or disabling any devices. It shall be the contractor’s responsibility to provide fire watch as per the latest addition

of the Fire Code of New York State. The contractor shall provide fire watch for all areas of a facility while occupied and unoccupied when any device or part of the fire alarm system is de-activated or put into “test mode”.

3.02 CUTTING AND PATCHING

A. Repair or replace routine damage caused by cutting in performance of work under this Division.

B. Correct unnecessary damage caused due to installation of electrical work, brought about through carelessness or lack of coordination.

C. Holes cut through floor slabs to be core drilled with drill designed for this purpose. All openings, sleeves, and holes in slabs to be properly sealed, fire proofed and waterproofed.

D. Repairs to be performed with materials which match existing materials and to be installed in accordance with appropriate sections of these specifications.

3.03 TESTS

A. On completion of work, installation shall be completely operational and entirely free from ground, short circuits, and open circuits. Perform a thorough operational test in presence of the Engineer. Balance all circuits so that feeders to panels are not more than 10% out of balance between phases with all available load energized and operating. Furnish all labor, materials and instruments for above tests.

B. Furnish Engineer with a copy of such tests including identification of each circuit and readings recorded, also the main service ground resistance test as described in Section 260526 of these specifications. Test information to include ampere readings of all panels and major circuit breakers, isolation resistance reading of motors and transformers.

3.04 IDENTIFICATION OF EQUIPMENT

A. Properly identify the following:
   1. Distribution panels.
   2. Disconnect switches.
   3. Service entrance equipment and main circuit breaker.

B. Use permanently attached black phenolic plates with 1/4-inch white engraved lettering on the face of each, attached with two sheet metal screws.

C. Panelboard identification plates shall indicate panel by name.

3.05 INSTALLATION

A. The Contractor shall carefully move and replace existing equipment, appliances and all related items, as required to conduct proposed work.

B. Install and conduct all work per applicable NEC, State and local codes.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Shop Drawings: Indicate demolition and removal sequence and location of salvageable items; location and construction of temporary work.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, safety of structure and dust control.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct egress width to exits.

E. Do not turn off electric equipment without authorization from Owner.

F. Conform to procedures applicable when discovering hazardous or contaminated materials.

G. Obtain a utilities mark-out of all buried underground utilities for telephone, electric, gas, sewer and water, including all customer owned utilities.

1.04 SCHEDULING

A. Schedule Work to coincide with new construction.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify field circuiting arrangements at White Plains High School new addition.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on visual field observation. Report discrepancies to the Engineer before disturbing existing installation.

D. Beginning of demolition means installer accepts existing condition.

3.02 PREPARATION

A. Coordinate utility service outages with Utility Company.

B. Provide power, wiring and connections to maintain all existing power, control and telemetry systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction, as indicated on drawings.

B. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

C. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

D. Repair adjacent construction and finishes damaged during demolition and extension work.

E. Provide caps and filler plates/plugs for all openings in equipment and enclosures after removal of conduits.

F. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

G. Remove demolished materials from site as work progresses.

H. Completely remove and dispose of all electrical power, control, and telemetry feeds including conduits, conductors, boxes and supports not scheduled to remain after new construction is tested and operational.

I. Where existing devices and equipment are called to be removed, Contractor shall maintain circuit continuity to all existing devices and equipment remaining on that circuit. Contractor shall provide all required conduit, conductors and boxes as required.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Remove temporary work.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wires and cables.

B. In general, the wires and cables included under this Section shall include, but not be limited to, the following:
   1. 600V power and control cable
   2. Communication cables

C. All conductors to be continuous from origin to panel or equipment termination without splices.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

B. NECA Standard of Installations.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

1.04 QUALITY ASSURANCE

A. Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacturing, installing and servicing of similar items with a history of successful production acceptable to the Engineer as specified herein and in accordance with the General Conditions.

B. Contractor shall submit the following information pertaining to the manufacturer(s):
   1. Complete literature, performance, and technical data describing the proposed equipment and listing of items made by the manufacturer.
   2. Location of closest service office from which this equipment shall be serviced.
   3. Location of closest parts inventory for item installation.

1.05 COORDINATION

A. Coordination:
   1. Coordinate wire and cable required with the equipment being furnished by others for the satisfactory operation of the equipment or system.
   2. Review installation procedures under other sections and contracts and coordinate them with the work specified herein.
   3. Notify other prime contractors in advance of the installation of the work included to provide them with sufficient time for installation and coordination of interrelated items that are included in their contracts and that must be installed in conjunction with the work included in this Section.

1.06 PROJECT CONDITIONS

A. Verify that embedded conduit, in masonry and concrete, is installed as shown on the Drawings prior to the work being enclosed by others.

B. The Contractor shall be present at all concrete pours made by the General Contractor.

C. Conductor sizes are based on copper at 75°C.

D. Wire and cable routing shown on Drawings is approximate unless dimensioned or specifically called for such as where conduit is to be embedded in concrete or masonry. Route wire and cable as required to meet project conditions and shall be routed above ceilings, directly under joists, in pipe trenches, where available, and in masonry. Where exposed conduit is permitted, it shall be run to maximize wall space.

E. Field verify destination location to determine cable routing.

F. Where wire and cable routing is not shown for proposed destination, determine exact routing and lengths required. Routing shall be reviewed with the Engineer.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Install products in accordance with manufacturer's recommendations.

B. Single copper conductors with 600-volt insulation.

C. Minimum size of feeder conductors and grounds shall be No. 12 AWG.

D. Insulation: No. 12 AWG and No. 10 AWG, provide ANSI/NFPA 70, Type THWN-2 for interior circuits and type XHHW-2 for exterior circuits. Exterior circuits shall be considered circuits where any portion of the circuit is run exterior of the building, in which case the entire length of the circuit shall be continuous wire of Type XHHW-2.

E. Use solid conductor for feeder and branch circuits, 10 AWG and smaller.

F. All conductors shall include complete set of manufacturer's markings for insulation and conductor size.

G. Manufacturers shall be SOUTHWIRE, PRYSMIAN GROUP, OKONITE, or approved equal.

H. Provide white colored neutral conductors; provide black, color coded phase conductors; provide green colored ground conductors.

2.02 4-PAIR CATEGORY 6 UNSHIELDED TWISTED PAIR CABLE

A. Manufacturers: Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. Belden Corporation, Carmel, IN (800) 246-2673.
   2. Avaya, Basking Ridge, NJ (800) 344-02232.
   3. Berk-Tek, Incorporated, New Holland, PA (800) 237-5835.
   4. CommScope, Hickory, NC (800) 982-1708.
   5. Draka Comteq, Franklin, MA (888) 541-7100.
   6. General Cable, Highland Heights, KY (800) 424-5666.
   7. Mohawk/CDT Leominster, MA (978) 537 9961.
   8. NORDX/CDT, Worcester, MA (800) 331-0779.
   9. Superior Essex, Atlanta, GA. (800) 685-4887.
   10. Tyco Electronics, Harrisburg, PA (800) 522-6752.

B. Conductors: 4 twisted pair - 24 AWG, solid copper w/ RJ-45 connector ends
   1. Individually insulated plenum rated conductors under common plenum rated sheath unless entire cable is installed within conduit/EMT or if area where cable is installed is not considered a return air plenum according to any applicable codes.

2. Complies with individual characteristics established in ANSI/TIA/EIA-568-B, and all addendums for Category 6 cable performance specification.
3. Overall Nominal Diameter: .365 x .165 in.
4. Nominal Impedance: 100 ohms plus or minus 15 percent.
5. Certified capable of performing to minimum 350 MHz.

C. Mechanical Characteristics
1. Operating temperature: -20°C to +80°C
2. Bulk cable weight: 29 lbs./1000 ft.
3. Maximum recommended pulling tension: 45 lbs.
4. Minimum bend radius: 1 in.

D. Flame test: UL1666 Riser

E. Electrical Characteristics:
1. Nom. Mutual Capacitance @ 1 KHz 15.0 pF/ft
2. Maximum Capacitance Unbalance (pF/100 m) 49.2 pF/100 m
3. Nominal Velocity of Propagation 70 %
4. Maximum Delay (ns/100 m) 510 @ 100MHz ns/100 m
5. Maximum Delay Skew (ns/100m) 25 ns/100 m
6. Maximum Conductor DC Resistance @ 20 Deg. C 9 Ohms/100 m
7. Maximum DCR Unbalance @ 20 Deg. C 3 %
8. Max. Operating Voltage - UL 300 V RMS

2.03 MECHANICAL CONNECTORS

A. Conductor tapping connectors shall be BURNDY Servit split bolt, Series KS and KS3, or approved equal.

B. Split bolt connectors shall use BURNDY Type SC Servit cover on indoor applications.

C. Terminal lugs shall be BURNDY Universal Terminal Series. Terminal lugs shall be sized for proper ampacity and proper number of conductor holes. Each conductor shall occupy only one hole on a terminal lug.

D. Conductor tapping connectors for multiple conductors shall be BURNDY Series V-Tap with V-Tap covers, and V-Blok mounting platforms.

2.04 BELOW GRADE EXTERIOR SPLICES

A. Manufacturer: 3M or approved equal

B. Model: 72-N series for inline splices

C. Model: 90-B1 for WYE splices

D. Splices shall be weatherproof, made with epoxy resin UL listed for direct burial.

E. For use with all exterior pull boxes and hand holes where splices are made.

F. Provide all connectors and crimp couplings as required.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:
   1. Make terminations in accordance with cable manufacturers instructions for the particular type of wire and cable.
   2. Splices are not allowed in the underground duct and manhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing.
   3. All splices shall be in made in terminal boxes.

B. Wire and Cable Sizes: The sizes of wire and cable shall be as shown on the Contract Drawings, or if not shown, as approved by the Engineer. Minimum size wire shall be No. 12 AWG for all power, lighting and receptacle circuits. Wires for control circuits shall be No. 14 AWG minimum. Wire for instrumentation circuits shall not be smaller than No. 16 AWG. If due to field routing the voltage drop exceeds 2.5%, the size of conductors shall be increased such that 2.5% is the maximum voltage drop incurred.

C. Number of Wires: The number of wires indicated on the Contract Drawings for the various control, indications, and metering circuits were determined for general schemes of control and for particular indication and metering systems. Coordinate wiring schemes with equipment schematics.

D. Wiring Identification: All wiring shall have a unique wire number and be labeled at both ends. Wire numbers shall correspond with the equipment terminal wire numbers. Where no wire numbers are indicated, the Contractor shall assign wire numbers. Wire numbers shall not be duplicated.

E. Cable Identification Tags: The Contractor shall furnish all labor and materials and affix in a permanent way to each cable in manholes, cable compartments and vaults, junction boxes, pull boxes and points of termination, a laminated plastic tag, bearing clearly printed, the cable number indicated on the Contract Drawings or some other approved identification number or symbol. All cables shall be temporarily tagged with its full ID number immediately after it has been pulled.

F. Wiring Supplies: Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used. Friction tape shall be in accordance with ASTM D69.

G. Training of Cable: Furnish all labor and material required to train cables around cable vaults within buildings and in manholes in any outdoor underground duct system. Sufficient length of cable shall be provided in each manhole and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. All manhole cables shall be arc and fireproofed.

H. Connections at Control Panels, Limit Switches and Similar Devices:
   1. Where stranded wires are terminated at panels, and/or devices connections shall be made by solderless lug, crimp type ferrule or solder dipped.
   2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make 7-strand, No. 12 AWG, wire terminations impractical, the Contractor shall terminate external circuits in an adjacent junction box of proper size and shall install No. 14 AWG stranded wires to the junction box in a conduit.

I. Pulling Temperature: Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40°F or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage with an ambient temperature not lower than 55 degrees F and pulling shall be completed during the work day for which the cable is removed from the protected storage.

J. Color Coding:
1. Conductor jacket shall be color coded as follows:

AC POWER

480V/277 Volt 3 phase	**208Y/120 Volt 3 phase (NEC)**
Phase A Brown	Phase A Black
Phase B Orange	Phase B Red
Phase C Yellow	Phase C Blue
Neutral White	Neutral White
Ground Green	Ground Green

2. Equipment Ground - GREEN

3.02 IDENTIFICATION

A. Identify wire and cable under provisions of Section 260553.

B. Identify each conductor with its circuit number.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 014500.

B. Inspect wire and cable for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Field Testing:
1. Wires and cables shall be tested before being connected to motors, devices or terminal blocks.
2. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.
3. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

E. Continuity Tests: All cables, wires and shields shall be tested for continuity. Testing for continuity shall be by test light or buzzer.

F. Insulation-Resistance Tests:
   1. 600V power and control cables and wires shall be tested for their insulation-resistance values. Test shall utilize a megohmmeter with applied voltage to be 1000VDC for one (1) minute. Insulation-resistance test shall be performed on each conductor with all other conductors grounded. The resistance value shall be 20 megohms or greater.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Bonding.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

1.03 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.01 COMPONENTS

A. Ground clamps:
   1. OZ ELECTRICAL MANUFACTURING COMPANY, Type "CG" for connection to water main piping and Type "GC" for connection to ground rod; with cable installed parallel or 90 degrees to pipe/rod under separate clamp.
   2. Or equal by STEEL CITY or APPLETON

B. Raceways, conductors, outlet boxes, pull and junction boxes to be furnished in accordance with applicable sections of these specifications.

C. Rod Electrode: Solid Copper, 3/4-inch diameter, 10 feet long.

D. Wire: Copper, sized to meet NFPA 70 requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:
   1. Clean all conductive surfaces on equipment to be grounded, to assure good electrical continuity.
   2. Effectively bond all grounding conductors to grounding rod electrodes, equipment enclosures and ground busses.
   3. Locate all grounding attachments away from areas subject to physical damage. Provide protective covering as required.
   4. Install service entrance building ground as per NEC and Local Utility requirements.
   5. Service entrance shall be bonded to street side of first flange or coupling of incoming main water line with heavy duty ground clamp. Bonding conductor to be sized in accordance with NFPA 70.
   6. Building steel shall be bonded to ground bus on main service with a conductor the same size as in B.1 below.
   7. Install new service grounds and grounding systems for new service as per Local Utility and NEC requirements.

B. Feeder/Branch Circuits:
   1. All circuits shall have a separate green grounding conductor in conduit sized in accordance with NFPA 70. Minimum size of conductor shall be No. 12 AWG.
   2. Flexible conduit will not be approved as achieving continuity of ground. All flexible conduit to have a jumper wire sized to ampacity of branch breaker and to be connected to conduit system on both ends; this applies to fixtures, motors, controls, etc.

C. Transformers:
   1. Transformers shall be grounded and grounding conductors and conduits sized in accordance with NFPA 70.

3.02 TEST

A. Test ground on main service. Ground system resistance shall be no greater than 10 ohms using test equipment similar to a "Biddle" test. Test data to be submitted to the Engineer for approval and such approved test data to become a part of the Record Documents.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. System of supporting devices and hangers for support or bracing for conduit, electrical equipment, safety switches, fixtures, panelboards, outlet boxes, junction boxes and cabinets.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

1.03 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.01 EQUIPMENT REQUIREMENTS

A. Provide appropriate corrosion-resistant supporting devices and hangers for electrical equipment, as manufactured by ERICO PRODUCTS, INC., CADDY FASTENERS, STEEL CITY, MINERALLAC or equivalent.
   1. "Z" purlin clips.
   2. Conduit clips.
   3. Beam clamps (universal and vertical flange).
   4. Beam clamps (set screw type).
   5. Combination push-in conduit clips.
   6. Combination conduit hanger clamps.
   7. Flexible conduit clips.
   8. Special combination conduit clips.
   9. One hole steel straps.
   10. Conduit hangers.

B. Provide materials, sizes and types of anchors, fasteners and supports to carry the loads of equipment, wire in conduit and conduit.

2.02 CHANNEL SUPPORT SYSTEM

A. Channel systems and supports shall be manufactured by KINDORF/THOMAS & BETTS, or approved equal.

B. Channels shall be 1-1/2" x 1-1/2".

C. Channels and all associated accessories and bolts shall be hot dipped galvanized.

D. Channels shall have 9/16" bolt holes on 1-1/2" centers.

E. Provide end caps for all channels.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Secure conduits to within 3 feet of each outlet box, junction box, cabinet, fitting, etc., and at intervals not to exceed 10 feet in accordance with currently effective edition of the National Electric Code.

B. In seismic zones, support conduits 1 inch and smaller at 6 foot intervals.

C. Install clamps secured to structure for feeder and other conduits routed against structure. Use drop rods and hangers to support conduits run apart from the structure.

D. Provide and install suitable angle iron, channel iron or steel metal framing with accessories to support or brace electrical equipment including safety switches, fixtures, panelboards, etc.

E. Paint all supporting metal not otherwise protected, with rust inhibiting primer and then with a finish coat if appropriate to match the surrounding metal surfaces. Prepainted or galvanized support material is not required to be painted or repainted.

F. Do not use chains, perforated iron, baling wire or tie wire for supporting conduit runs. Use of clips to support conduit to top of t-bar ceiling grid will not be permit-ted.

G. Obtain permission from Engineer before drilling or cutting structural members.

H. Install surface mounted cabinets and panelboards with a minimum of four anchors.

I. Do not fasten supports to pipes, ducts, mechanical equipment and conduit.

J. Install products in accordance with manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Conduit system with associated couplings, connectors and fittings. Conduits to be mechanically and electrically continuous from outlet to outlet and from outlets to cabinets, pull or junction boxes.
   1. Conduit Use - Rigid Galvanized Conduit:
      a. All exterior circuits above ground.
      b. All circuits concealed in CMU exterior walls.
   2. Conduit Use - PVC Sch. 80
      a. All exterior circuits below ground.
   3. Conduit Use - Electrical Metallic Tubing (EMT) Conduit:
      a. All interior circuits above ground.
      b. All circuits concealed in CMU interior walls.
   4. Conduit Use - Metal Clad (MC) Cable:
      a. All 15 and 20 amp branch circuits concealed in walls or ceilings.
   5. Conduit Use - Flexible Liquid-tight Metal Conduit:
      a. Connecting motors, generators and other equipment subject to vibration, maximum length - 3 feet.
      b. Passing through building expansion joints.
   6. J-Hooks
      a. For use above finished ceilings for telephone, PA, CAT 6 data and fire alarm cable only.

B. Device Boxes: Provide each fixture switch, receptacle and other wiring device with a box of appropriate size and depth for its particular location use unless indicated otherwise.

C. Pull boxes, junction boxes and wire troughs

1.02 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI/NFPA 70 - National Electric Code.

C. NECA Standard of Installation.

D. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

E. NEMA TC 3 - PVC Fittings for use with Rigid PVC conduit and tubing.

F. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

G. ANSI/NEMA OS1 - Sheet-steel outlet boxes, device boxes, covers and box supports.

H. NEMA 250 - Enclosures for electrical equipment (1000 volts maximum).

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Working Drawings:
   1. Prior to equipment submission, submit a list of proposed manufacturers with the products they produce proposed for the contract.

2. Manufacturer's catalog cuts for the conduit, boxes, fittings and supports proposed for use.
3. Construction details of conduit racks and other conduit support systems with seismic restraint details and calculations signed by a licensed Engineer.
4. Scaled working drawings showing proposed routing of all conduits, inclusive of conduits routed above grade on exterior support structures, embedded in structural concrete and conduits directly buried in earth. Drawings shall show locations of pull and junction boxes and all penetrations in walls and floor slabs.

1.04 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories, Inc.

B. Conform to requirements of ANSI/NFPA 70.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839.

B. Accurately record actual routing of all conduits.

1.06 FIELD SAMPLES

A. Provide under provisions of Section 014500.

B. Provide field sample of conduit two each at 2 feet in length.

C. Provide field sample of expansion/deflection fitting, two each.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect, and handle products in accordance with manufacturers' recommendations.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing abovegrade. Provide appropriate covering.

1.08 PROJECT CONDITIONS

A. Verify all conduit routings by field measurements.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system. Provide all required sweeps, boxes and fittings.

PART 2 - PRODUCTS

2.01 RIGID GALVANIZED CONDUIT

A. Rigid conduit shall be hot dipped, galvanized, or electro-galvanized steel by Wheatland, Triangle, Republic or approved equal.

B. Associated couplings, connectors and fittings shall be as manufactured by THOMAS & BETTS CORP., O.Z. GEDNEY CO., EFCOR or approved equal. Catalog numbers used below are

those of THOMAS & BETTS CORP. based on 3/4-inch size and are considered standards by which equivalents are to be judged.

C. ERICKSON couplings, Series 676 or approved equal, shall be used where neither length of conduit can be rotated.

D. Conduit connectors shall be threaded type. Set screw and compression type connections ARE NOT acceptable.

E. Sealing fitting locknuts shall be Series 142SL.

F. Steel or malleable iron insulated bullet hub, Series 370-379, complete with sealing "O" ring. DO NOT use "die cast" material.

G. Entrance ells shall be Series 1491 or approved equal.

H. Combination coupling shall be Series 531 for connecting rigid galvanized conduit to electrical metallic tubing.

2.02 PVC CONDUIT

A. PVC conduit shall be manufactured by WHEATLAND, TRIANGLE REPUBLIC or approved equal.

B. Description: NEMA TC 2; Schedule 80 PVC.

C. Fittings and Conduit Bodies: NEMA TC3.

2.03 ELECTRICAL METALLIC TUBING (EMT)

A. Electrical metallic tubing shall be WHEATLAND, TRIANGLE, REPUBLIC, or approved equal.

B. Associated couplings, connectors and fittings shall be as manufactured by THOMAS & BETTS CORP., O.Z. GEDNEY CO., EFCOR, or approved equal. Catalog numbers used below are those of THOMAS & BETTS CORP. based on 3/4-inch size and are considered standards by which equivalents are to be judged.

C. EMT connectors shall be TC-2125C compression type with threaded locknut. Set screw connectors will not be acceptable.

D. EMT couplings shall be TK-2125C compression type. Set screw connectors will not be acceptable.

2.04 METAL CLAD CABLE (MC)

A. Metal clad cable shall be manufactured by BICCGENERAL or approved equal.

B. Associated couplings, connectors and fittings shall be as manufactured by THOMAS & BETTS CORP., O.Z. GEDNEY CO., EFCOR or approved equal.

C. Conductors shall be types THHN and THWN. Ground wire shall be sized as per NEC with green THHN/THWN insulation. All conductors shall be cabled and wrapped in polyester tape. All conductors shall be rated for 600 VAC.

D. Armor material shall be Aluminum Interlocked Armor.

2.05 DUCT SEAL

A. RectorSeal or approved equal.

B. Model #: 81881

2.06 J-HOOKS

A. TO BE USED ABOVE FINISHED CEILING ONLY. FOR TELEPHONE, PA, CAT 6 DATA AND FIRE ALARM CABLE ONLY. ALL EXPOSED TELEPHONE, PA, CAT 6 DATA AND FIRE ALARM CABLE SHALL BE IN CONDUIT.

B. Erico Caddy HP J. Hook Series or approved equal.

C. Provide wire retainers for all.

D. Provide mounting hardware and accessories as required.

E. Spacing of J-Hooks and supports shall not exceed 5’-0” on center.

2.07 FLEXIBLE LIQUID-TIGHT METAL CONDUITS AND FITTINGS

A. Liquid-tight flexible metal conduit shall be ANACONDA or approved equal.

B. Description: Interlocked steel construction with PVC jacket.

C. Provide flexible liquid-tight conduits and fittings as manufactured by THOMAS & BETTS CORP., O.Z. GEDNEY CO. or approved equal. Catalog numbers used below are those of the THOMAS & BETTS CORP., based on 3/4" size and are to be considered as standards by which equivalents are to be judged. All conduit shall be liquid-tight flexible type, UL type UA, or suitable for exposure to continuous or intermittent moisture.

D. Flexible liquid-tight connectors shall be Series 5333 or approved equal.

2.08 OUTLET AND DEVICE BOXES

A. Acceptable Manufacturers: Raco, General Electric or approved equal.

B. Sheet Metal Outlet Boxes - All concealed boxes shall be NEMA OSI, galvanized steel:
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported. Provide 1/2" male fixture stubs where required.

C. Concrete Ceiling Boxes: Concrete type.

D. Cast Boxes: All exposed surface mounted boxes shall be NEMA FB1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer.

2.09 UTILITY EXTERIOR PULL BOXES

A. All pull boxes used for this project shall be minimum Con Edison B-3-6 or specifically approved equal for all customer installed power and control circuits.

B. Provide H-20 Cast-Iron Traffic Load Cover. Cover shall have 3” high logo “Electric”.

2.10 GENERAL EXTERIOR PULL BOXES

A. Provide Tier 22 traffic loaded pull boxes and Tier 22 traffic loaded covers. Cover shall have logo "ELECTRIC"

B. Manufacturer shall be Quazite or approved equal.

C. Model Number: PG1730 BB24 and HH cover.

D. Minimum dimensions shall be 17"W x 30"L x 28"D

E. Grout around all conduits entering/exiting the pull box and duct seal the conduits.

F. Site plans show the minimum required pull boxes. Provide and install additional pull boxes as required and by NEC requirements.

2.11 JUNCTION BOXES

A. Acceptable Manufacturers: RACO, GENERAL ELECTRIC or approved equal.

B. Sheet metal boxes: NEMA OS1, galvanized steel.

C. Covers: Galvanized steel.

2.12 WIRE TROUGH

A. Wireways shall be manufactured by Square D, Class 526, rain tight trough or approved equal.

B. Wireway shall be completely enclosed with removable covers.

C. Construction: 16 Gauge Galvanized Steel. 8-inch and 12-inch wire trough shall be 14-gauge galvanized steel.

D. Finish: ANSI-49 epoxy paint applied by cathodic electro-deposition paint process over a corrosion resistant phosphate preparation.

E. UL listed.

2.13 EXTERIOR WIRE TROUGH

A. Wireways shall be manufactured by SQUARE D, Class 526, rain tight.

B. Wireway shall be completely enclosed with removable covers.

C. Construction: Wireway shall be constructed of Type 304 stainless and shall have stainless steel screw clamps, and oil resistant gaskets.

D. All hardware, bolts, brackets, and supports shall be constructed of Type 304 stainless steel.

2.14 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT THREAD COMPOUND

A. KOPR-SHIELD or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF CONDUITS

A. Minimum size of conduits shall be 3/4-inch.

B. Minimum conduit depth shall be 24" below grade, measured to the top of the conduit on exterior underground installations.

C. Conduit joints shall be cut square, threaded, reamed smooth, and drawn up tight so conduit ends will butt in couplings, connectors and fittings.

D. All threaded conduits and fittings shall have KOPR-SHIELD compound applied to all threads prior to assembly.

E. Make bends or offsets with standard ells or field bends with an approved bender.

F. Run concealed conduits in direct line with long sweep bends or offsets. Run exposed conduits parallel to and at right angles to building lines. Group multiple conduit runs in banks.

G. Secure conduits to all boxes and cabinets with double locknuts and bushings so system will be electrically continuous from service to all outlets.

H. Install conduit in accordance with NECA Standard of Installation.

I. Cap ends of conduits to prevent entrance of water and other foreign material during construction.

J. Complete all conduit systems before pulling conductors.

K. Support conduits under provisions of Section 260529.

L. Provide approved expansion joints or fittings and bonding jumpers where conduits in concrete pass through building expansion joints.

M. Provide cable supports in conduits rising vertically in accordance with the National Electric Code, Article 300-19.

N. Provide No. 12 AWG copper pull wires or nylon cord in all empty conduits. Steel wire not acceptable as pull wire.

O. Install conduit to preserve fire resistance rating of partitions and other elements.

P. Ground and bond conduit under provisions of Section 260526.

Q. Where neither length of conduit can be rotated, ERICKSON couplings Series 676 shall be used.

R. In areas where enclosed and gasketed fixtures and weatherproof devices are specified, where rigid conduit enters a sheet metal enclosure, junction box and outlet box, and not terminated in a threaded hub, a steel, or malleable iron nylon insulated bullet hub, complete with recessed sealing "O" ring, shall be used, Series 370-379 . DO NOT use die cast material.

S. Conduits shall not be installed within concrete slabs unless specifically noted in contract documents; no exceptions.

T. Where conduits running overhead pass through building expansion joints, install flexible liquid tight conduit of same size with sufficient slack to allow conduits on either side of expansion joint to move a minimum of 3-inches in any direction. Provide supports as required on each side of expansion joint, all in accordance with seismic requirements of specific area.

U. Failure to route conduit through building without interfering with other equipment and construction shall not constitute a reason for an extra charge. Equipment, conduit and fixtures shall fit into available spaces in building and shall not be introduced into building at such times and manner as to cause damage to structure. Equipment requiring servicing shall be readily accessible.

V. Arrange supports to prevent misalignment during wiring installation.

W. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

X. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

Y. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

Z. Do not attach conduit to ceiling support wires.

AA. Arrange conduit to maintain headroom and present neat appearance.

AB. Route exposed conduit parallel and perpendicular to walls.

AC. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

AD. Route conduit in and under slab from point-to-point.

AE. Do not cross conduits in slab.

AF. Maintain adequate clearance between conduit and piping.

AG. Maintain 12-inch clearance between conduit and surfaces with temperatures exceeding 104°F (40°C).

AH. Bring conduit to shoulder of fittings; fasten securely.

AI. Use conduit hubs with sealing locknuts to fasten conduit in damp and wet locations.

AJ. Install no more than equivalent of three 90-degree bends on interior locations between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2-inch size.

AK. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

AL. Do not use dissimilar strap or clamp supports. Provide dielectric tape, fittings, straps, and bushings where dissimilar metals are used.

AM. Where fittings for liquid-tight flexible conduit are brought into an enclosure with a knockout, a gasket assembly, consisting of one piece "O" ring, with a Buna-R sealing material, Series 5200, shall be installed on outside of box. Fittings shall be made of either steel or malleable iron only, and shall have insulated throats or insulated bushings.

AN. A copper ground wire sized in accordance with NEC shall be installed on the inside of the conduit as a jumper around flexible conduit to assure a continuity of ground.

AO. Install a copper jumper across all flexible conduit including lighting fixtures, controls and other utilization equipment.

AP. Install liquid-tight flexible conduit in such a manner as to prevent liquids from running on surface toward fittings.

AQ. Allow sufficient slack conduit to reduce the effect of vibration.

AR. Complete all conduit systems before pulling the conductors.

AS. Support in accordance with requirements of National Electric Code.

3.02 INSTALLATION OF BOXES

A. Install boxes concealed in finished walls.

B. Locate boxes to prevent moisture from entering or accumulating within them.

C. Support boxes independently of conduit, as required by the National Electric Code.

D. Provide 4" x 1-1/2" octagonal, 4" x 1-1/2" square or 4" x 2-1/8" square ceiling outlet boxes.

E. All boxes, conduit bodies, and handholes shall be installed in a manner which meets the accessible and readily accessible reuirements of the NEC, including in building with suspended ceilings and hold down clips.

F. Where required to hang a specific fixture, provide a fixture stud of the no-bolt, self-locking type on ceiling outlets.

G. Provide 2-1/2" x 3-3/4" one gang masonry boxes for switches and receptacles installed concealed in concrete block walls. For increased cubic capacity, provide 3-1/2" x 3-3/4" one gang masonry boxes. Where more than two conduits enter the box from one direction, provide 4" square boxes with square cut device covers not less than 1" deep specifically designed for this purpose. Use round edge plaster rings only if the block walls are to be plastered. Use sectional or gang-type outlet boxes only in drywall construction.

H. Provide 4-11/16" square outlet boxes with square cut device corners for block walls or round edge plaster rings for plastered walls for telephone outlets. Single gang device boxes are not acceptable.

I. Provide fittings with threaded hubs for screw connections and with the proper type covers for switches and receptacles served by exposed conduit. Use pressed steel outlet only for ceiling fixture outlets.

J. Provide condulets with threaded hubs and covers and with proper configurations for all changes of direction of exposed conduits. Standard conduit ells may be used if they do not interfere or damage or mar the appearance of the installation.

K. Use boxes of sufficient cubic capacity to accommodate the number of conductors to be installed, in accordance with the National Electric Code.

L. Effectively close unused openings in boxes with metal plugs or plates.

M. Set boxes so that front edges are flush with finished surfaces.

N. Support boxes from structural members with approved braces.

O. Install blank device plates on outlet boxes left for future use.

P. Provide bushings in holes through which cords or conductors pass.

Q. Install boxes so that the covers will be accessible at all times.

R. Electrical boxes may be installed in vertical fire resistive assemblies classified as fire/smoke and smoke partitions without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. All clearance between such boxes and the gypsum board shall be completely filled with joint compound or approved fire-resistive compound. The wall shall be built around outlet boxes larger than 16 square inches so as not to interfere with the wall rating.

3.03 INSTALLATION OF PULL BOXES, JUNCTION BOXES AND WIRE TROUGHS

A. Provide junction boxes as shown on Drawings and otherwise where required, sized according to number of conductors in box or type of service to be provided. Minimum junction box size 4-inch square and 2-1/8-inches deep. Provide screw covers for junction boxes.

B. Install boxes in conduit runs wherever necessary to avoid long runs or too many bends. Do not exceed 100-foot runs without pull boxes. Install pull boxes at all 90-degree bends.

C. Rigidly secure boxes to walls or ceilings. Conduit runs will not be considered adequate support.

D. Install boxes with covers in accessible locations. Size boxes in accordance with the National Electric Code.

E. Do not install pull boxes or junction boxes for joint use of line voltage and signal or low voltage controls unless all conductors are insulated for the highest voltage being used in the same box.

F. Coordinate installation of exterior pull boxes with General contractor to establish elevations of finished grades and pavements. All castings shall have chimney adjustment of + 6”.

3.04 CONDUIT LOCATIONS

A. Route all conduit concealed in walls or above finished ceilings. Provide boxes and conduits concealed in walls for all power and controls. Conduit will not be permitted within new floor slab.

B. Surface mounted conduits will only be allowed in electrical rooms. Surface mounted conduits shall only be permitted for vertical runs. All horizontal runs shall be installed above finished ceilings.

C. All conduit shall be primed and painted to match existing adjacent wall color.

D. J-Hooks are only permitted to be used above finished ceilings for telephone, PA, CAT 6 data and fire alarm cable.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

1.02 REFERENCES

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. Submit under provisions of Section 013300 - SUBMITTALS.

B. Product Data: Provide catalog data for nameplates, labels and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Underwriters Laboratories, Inc. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic, white letters on black background.

B. Locations:
1. Distribution panelboards.
2. Switches.
3. Switchboard

C. Letter Size:
1. Use 1/4 inch (6 mm) letters for identifying all control pilot lights.

D. Labels: Embossed adhesive tape, with 3/16” (5mm) white letters on black background. Use for identifying existing equipment, distribution panels, switchboards, disconnect switches, and individual electrical devices.

2.02 WIRE MARKERS

A. Manufacturers:
1. 3M ELECTRICAL SPECIALTY DIV., Product Scotch Code.
2. THOMAS & BETTS CORP., Product E-Z Code.
3. Substitutions shall be permitted only after receiving written approval from the Engineer.

B. Description: Epoxy film tape type wire markers.

C. Locations: Each conductor at panelboards, auxiliary gutters, pull boxes, outlet and junction boxes, circuit breakers and each load connection.

D. Legend:
   1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
   2. Control Circuits: Control wire number indicated on interconnection diagrams on drawings.

2.03 CONDUIT MARKERS

A. Manufacturers:
   1. THOMAS & BETTS CORP.
   2. Substitutions shall be permitted only after receiving written approval from the Engineer.

B. Description: Self-sticking vinyl; black letters on orange background.

C. Location: Furnish markers for each conduit longer than 6 feet (1.8 m).

D. Spacing: 20 feet (6 m) on center.

2.04 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. THOMAS & BETTS CORP., Model NAF-0700.
   2. Substitutions shall be permitted only after receiving written approval from the Engineer.

B. Description: 6 inch (150 mm) wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

A. Install nameplate and label parallel to equipment lines.

B. Secure nameplate to equipment front using screws, rivets or adhesive.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Apply conduit markers at 20 foot (6 m) intervals.

E. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches (75 mm) below finished grade.

3.03 ELECTRICAL EQUIPMENT IDENTIFICATION

A. The Contractor shall identify all existing circuits in existing distribution panels, switchboards and disconnect switches to remain.

B. Label all circuits identifying the load served including all individual circuit breakers.

C. Label all new circuit breakers and switches used for new feeder and branch circuits.

D. Contractor shall furnish a minimum of 5 custom engrave three-layer laminated plastic labels with up to 20 words per label as directed by the engineer/owner in addition to the required labels for all pilot devices, switches, controls and timers.

END OF SECTION

SECTION 260574 - ARC FLASH HAZARD ANALYSIS AND SHORT CIRCUIT COORDINATION STUDY
H2M

PART 1 - GENERAL

1.01 SCOPE

A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the equipment manufacturer being furnished on the project. **Third Party Studies Shall Not Be Acceptable**.

B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E - Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584-2002, the IEEE Guide for Performing Arc-Flash Calculations.

C. The scope of the studies shall include new distribution equipment supplied under this contract.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract.

1.03 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
   2. IEEE 242 -Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
   3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
   4. IEEE 241 -Recommended Practice for Electric Power Systems in Commercial Buildings
   5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
   6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):
   1. ANSI C57.12.00- Standard General Requirements for Liquid-Immersed Distribution, Power, and .Regulating Transformers
   2. ANSI C37.13- Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
   3. ANSI C37.010- Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
   4. ANSI C 37.41- Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)
   1. NFPA 70 -National Electrical Code, latest edition
   2. NFPA 70E- Standard for Electrical Safety in the Workplace

1.04 SUBMITTALS FOR REVIEW/APPROVAL

A. The studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the study may cause delays in equipment shipments, approval from the Engineer may be obtained for a preliminary submittal of data to ensure that the selection of device ratings and characteristics will be satisfactory to properly select the distribution equipment. The formal study will be provided to verify preliminary findings.

1.05 SUBMITTALS FOR CONSTRUCTION

A. The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. A minimum of five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short- circuit input and output data. Electronic PDF copies of the report shall be provided upon request.

B. The report shall include the following sections:
   1. Executive Summary including Introduction, Scope of Work and Results/Recommendations.
   2. Short-Circuit Methodology Analysis Results and Recommendations
   3. Short-Circuit Device Evaluation Table
   4. Protective Device Coordination Methodology Analysis Results and Recommendations
   5. Protective Device Settings Table
   6. Time-Current Coordination Graphs and Recommendations
   7. Arc Flash Hazard Methodology Analysis Results and Recommendations including the details of the incident energy and flash protection boundary calculations, along with Arc Flash boundary distances, working distances, Incident Energy levels and Personal Protection Equipment levels.
   8. Arc Flash Labeling section showing types of labels to be provided. Section will contain descriptive information as well as typical label images.
   9. One-line system diagram that shall be computer generated and will clearly identify individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current a each bus location, device numbers used in the time-current coordination analysis, and other information pertinent to the computer analysis.

1.06 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the responsible charge and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.

B. The Registered Professional Electrical Engineer shall be an employee of the equipment manufacturer or an approved engineering firm.

C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies.

D. The approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analyses it has performed in the past year.

E. The engineering firm shall have a minimum of twenty-five (25) years of experience in performing power system studies.

1.07 COMPUTER ANALYSIS SOFTWARE

A. The studies shall be performed using SKM Systems Analysis Power*Tools for Windows (PTW) software program.

PART 2 - PRODUCT

2.01 STUDIES

A. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D. This study shall also include short-circuit and protective device coordination studies. All studies to be prepared by Square D Engineering Services.

2.02 DATA

A. Contractor shall furnish all data as required for the power system studies. The Engineer performing the short circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.

D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 SHORT-CIRCUIT ANALYSIS

A. Transformer design impedances shall be used when test impedances are not available.

B. Provide the following:
   1. Calculation methods and assumptions
   2. Selected base per unit quantities
   3. One-line diagram of the system being evaluated that clearly identifies individual equipment buses, bus numbers used in the short-circuit analysis, cable and bus connections between the equipment, calculated maximum short-circuit current at each bus location and other information pertinent to the computer analysis
   4. The study shall include input circuit data including electric utility system characteristics, source impedance data, conductor lengths, number of conductors per phase, conductor impedance values, insulation types, transformer impedances and X/R ratios, motor contributions, and other circuit information as related to the short-circuit calculations.
   5. Tabulations of calculated quantities including short-circuit currents, X/R ratios, equipment short-circuit interrupting or withstand current ratings and notes regarding adequacy or inadequacy of the equipment rating.
   6. Results, conclusions, and recommendations. A comprehensive discussion section evaluating the adequacy or inadequacy of the equipment must be provided and include recommendations as appropriate for improvements to the system.

C. For solidly-grounded systems, provide a bolted line-to-ground fault current study for applicable buses as determined by the engineer performing the study.

D. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short circuit ratings
   2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short circuit stresses

3. Square D shall notify Owner in writing, of any circuit protective devices improperly rated for the calculated available fault current.

2.04 PROTECTIVE DEVICE TIME-CURRENT COORDINATION ANALYSIS

A. Protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.

B. Include on each TCC graph, a complete title with descriptive device names.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.

D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the TCC graphs, where applicable:
   1. Electric utility's overcurrent protective device
   2. Medium voltage equipment overcurrent relays
   3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
   4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
   5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
   6. Medium voltage conductor damage curves
   7. Ground fault protective devices, as applicable
   8. Pertinent motor starting characteristics and motor damage points, where applicable
   9. Pertinent generator short-circuit decrement curve and generator damage point
   10. The largest feeder circuit breaker in each motor control center and applicable panelboard.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

G. Provide the following:
   1. A One-line diagram shall be provided which clearly identifies individual equipment buses, bus numbers, device identification numbers and the maximum available short-circuit current at each bus when known.
   2. A sufficient number of log-log plots shall be provided to indicate the degree of system protection and coordination by displaying the time-current characteristics of series connected overcurrent devices and other pertinent system parameters.
   3. Computer printouts shall accompany the log-log plots and will contain descriptions for each of the devices shown, settings of the adjustable devices, and device identification numbers to aid in locating the devices on the log-log plots and the system one-line diagram.
   4. The study shall include a separate, tabular printout containing the recommended settings of all adjustable overcurrent protective devices, the equipment designation where the device is located, and the device number corresponding to the device on the system one-line diagram
   5. A discussion section which evaluates the degree of system protection and service continuity with overcurrent devices, along with recommendations as required for addressing system protection or device coordination deficiencies.
   6. Square D shall notify Owner in writing of any significant deficiencies in protection and/or coordination. Provide recommendations for improvements.

2.05 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2009, Annex D. The arc flash hazard analysis shall be performed in conjunction with the short-circuit analysis (Section 2.03) and the protective device time-current coordination analysis (Section 2.04)

B. The flash protection boundary and the incident energy shall be calculated at significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

C. Circuits 240V or less fed by single transformer rated less than 125 kVA may be omitted from the computer model and will be assumed to have a hazard risk category 0 per NFPA 70E.

D. Working distances shall be based on IEEE 1584. The calculated arc flash protection boundary shall be determined using those working distances.

E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations

F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location in a single table. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum. Conversely, the maximum calculation will assume a maximum contribution from the utility. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable as well as any stand-by generator applications.
   1. The Arc-Flash Hazard Analysis shall be performed utilizing mutually agreed upon facility operational conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.

G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors should be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond 5 cycles.

H. For each piece of ANSI rated equipment with an enclosed main device, two calculations shall be made. A calculation shall be made for the main cubicle, sides, or rear; and shall be based on a device located upstream of the equipment to clear the arcing fault. A second calculation shall be made for the front cubicles and shall be based on the equipment's main device to clear the arcing fault. For all other non-ANSI rated equipment, only one calculation shall be required and it shall be based on a device located upstream of the equipment to clear the arcing fault.

I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.

J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. A maximum clearing time of2 seconds will be used based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Provide the following:
   1. Results of the Arc-Flash Hazard Analysis shall be submitted in tabular form, and shall include device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, working distances, personal-protective equipment classes and AFIE (Arc Flash Incident Energy) levels.
   2. The Arc-Flash Hazard Analysis shall report incident energy values based on recommended device settings for equipment within the scope of the study.
   3. The Arc-Flash Hazard Analysis may include recommendations to reduce AFIE levels and enhance worker safety.

PART 3 - EXECUTION

3.01 FIELD ADJUSTMENT

A. Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.

B. Contractor shall make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Square D shall notify Owner in writing of any required major equipment modifications.

3.02 ARC FLASH LABELS

A. Square D Engineering Services shall provide a 4.0 in. x 4.0 in. Brady thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The labels shall be designed according to the following standards:
   1. UL969 - Standard for Marking and Labeling Systems
   2. ANSI Z535.4- Product Safety Signs and Labels
   3. NFPA 70 (National Electric Code)- Article 110.16

C. The label shall include the following information:
   1. System Voltage
   2. Flash protection boundary
   3. Personal Protective Equipment category
   4. Arc Flash Incident energy value (cal/cm2)
   5. Limited, restricted, and prohibited Approach Boundaries
   6. Study report number and issue date

D. Labels shall be printed by a thermal transfer type printer, with no field markings.

E. Arc flash labels shall be provided for equipment as identified in the study and the respective equipment access areas per the following:
   1. Floor Standing Equipment - Labels shall be provided on the front of each individual section. Equipment requiring rear and/or side access shall have labels provided on each individual section access area. Equipment line-ups containing sections with multiple incident energy and flash protection boundaries shall be labeled as identified in the Arc Flash Analysis table.

2. Wall Mounted Equipment- Labels shall be provided on the front cover or a nearby adjacent surface, depending upon equipment configuration.
3. General Use Safety labels shall be installed on equipment in coordination with the Arc Flash labels. The General Use Safety labels shall warn of general electrical hazards associated with shock, arc flash, and explosions, and instruct workers to turn off power prior to work.

F. Labels shall be field installed by Square D Services. The technician providing the installation shall have completed an 8-Hour instructor led Electrical Safety Training Course with includes NFPA 70E material including the selection of personal protective equipment.

3.03 ARC FLASH TRAINING

A. The vendor supplying the Arc Flash Hazard Analysis shall train the owner's qualified electrical personnel of the potential arc flash hazards, associated with working on energized equipment (minimum of 4 hours). The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent. The trainer shall be an authorized OSHA Outreach instructor.

B. The vendor supplying the Arc Flash Hazard Analysis shall offer instructor led and online NFPA 70E training classes.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surge protection device.

1.02 RELATED SECTIONS

1.03 STANDARDS

A. The specified suppressor shall be designed, manufactured, tested and installed in compliance with:
   1. American National Standards Institute and Institute of Electrical and Electronic Engineers (ANSI/IEEE C62.11, C62.41 and C62.45).
   2. Federal Information Processing Standards Publication 94 (FIP PUB 94).
   3. National Electrical Manufacturer Association (NEMA LS-1).
   4. National Fire Protection Association (NFPA 20, 70, 75 and 78).
   5. Underwriters Laboratories (UL 1449).
   6. CAN/C22.2 No. 8-M1986; CSA Electrical Certification Notice No. 516.
   7. The system individual units shall be UL listed under UL 1449 Standard for Transient Voltage Surge Suppressions (TVSS) and the surge ratings shall be permanently affixed to the TVSS.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. MCG ELECTRONICS, INC., Deer Park, New York.

B. Approved equal.

2.02 MANUFACTURED UNITS

A. Surge suppression shall be series Surge Free Model No. 400LS

2.03 SYSTEM REQUIREMENTS

A. The specified surge protective device shall provide effective high energy surge diversion for application ANSI/IEEE C62.41-1991 Location Category C3 environments. Testing per ANSI/IEEE C62.45-1992 using ANSI/IEEE C62.41 Category C3 waveforms and amplitudes. UL 1449 listing. The specified surge protective device shall provide:
   1. 400,000 transient amps, per phase of surge protection.
   2. Peak surge current ratings must be independently tested and verified.
   3. All mode protection, L-N, L-G, L-L, N-G.
   4. Integral disconnect with safety dead front.
   5. Each MOV protected from over-current, thermal overload and monitored individually.
   6. Self diagnostics with comprehensive LED bar graph on front panel showing the exact % level of protection available.
   7. Audible fault alarm with silence switch.
   8. Event counter, indication of time and date of last event (battery backup for time and date).
   9. Remote alarm relay contacts (surge protected), Form C.
   10. Micro-Z low impedance installation cable.
   11. Twenty year warranty on entire system.
   12. LIFETIME “NO NONSENSE” WARRANTY ON FIELD REPLACEABLE POWER MODULES AND FUSES.

B. Environmental Requirements:
   1. Magnetic Fields: Connection shall be made using low impedance Micro-Z cabling provided with the suppressor for maximum magnetic field cancellation. Unit shall be shunt-installed with no series connected elements.
   2. Operating Temperature: Operating temperature range shall be -40° to +71° C (-40° to +160° F).
   3. Storage Temperature: Storage temperature range shall be -40° to +85° C.
   4. Relative Humidity: Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.
   5. Operating Altitude: The system shall be capable of operation up to an altitude of 13,000 feet above sea level.
   6. Operating Voltage: Maximum continuous operating voltage shall be no less than 115% and no greater than 125% of the nominal rated line voltage.
   7. Power Frequency: The power frequency range shall be 47 to 63.

C. Electrical Requirements:
   1. Unit Operating Voltage Requirements:

Voltage:	Description:	Joules (8/20us):	Vpeak L-N (20kV, 10kA):	Vpeak L-N (6kV, 500A):
277/480 VAC	3phase, 4W + gnd, wye	80640	1130V	1500V

   2. Unit shall be installed in parallel with the protected equipment. No series connected protective elements shall be used.
   3. The maximum surge current capacity per phase of the specified system, based on the standard IEEE 8/20 microsecond waveform, shall be at least: 1 Event at 400 kA. The surge life (8/20us) shall be at least 10,000 @ 15 kA occurrences. The transient suppression capability shall be bi-directional and suppress both positive and negative impulses.
   4. The suppressor shall be capable of interrupting a 200 kA, short circuit current delivered from the AC power line. The interrupt capability must be confirmed and documented by a recognized independent testing laboratory.
   5. The suppressor shall be designed so as to minimize the internal surge path impedance. Direct point-to-point internal wiring is inherently inductive and not acceptable. Connection to the power service shall be constructed for best performance.
   6. Equipment shall be as manufactured by MCG Electronics, Inc.: Model: 400LS-Family or engineering department approved equal with supporting test data.

D. Protection System Components:
   1. Replaceable modules: The suppressor shall be constructed using field replaceable protection modules. The suppressor shall have individually fused and monitored 40mm Metal Oxide Varistors (MOV's), including neutral to ground protection mode. Each module will provide five times (5X) redundant protection, with three modules per each phase and five fuses per module. The status of each module shall be locally monitored with a green LED that becomes red in a fault condition. The transient peak rating of the fuse shall be coordinated with the Ipeak handling capability of the MOV so that the surge path capability is not limited by the series fusing. In addition, each MOV shall incorporate a thermal disconnect means to remove a shorted MOV safely from the protection system.
   2. Self-Diagnostics: Red, green and yellow solid state LED indicators shall be provided on the hinged front cover to indicate protection status. An illuminated green LED indicates power is present at the protector on all phases, and an illuminated red LED shall indicate that one or more of the modules have reduced protection. An illuminated yellow LED shall indicate a suppression event. Both front panel and internal LEDs are required to provide

power and fault indications in the event of even the loss of a single fuse or MOV. Relay operation shall be in a fail-safe operating mode (i.e., continuously energized so that power failure, reduced protection, or a break in the remote monitoring line will cause a fault indication at the remote monitor).

3. Remote Alarm Capability: Relay alarm contacts shall be provided for remote alarm monitoring capability of unit status. Form C normally open and normally closed contacts shall be provided with voltage and current limiting protection.
4. Audible Alarm: The specified system shall be equipped with an audible alarm which shall be activated when any one or more of the modules has a reduced protection condition. A mute option shall be provided for the audible alarm.
5. Advanced Diagnostic LED Display: A front panel, microprocessor controlled LED display, in the form of a bar graph, will indicate the protection status of each MOV on each phase including neutral to ground. A event counter will display number of suppressed transient events with a time and date stamp.
6. Integral Disconnect: Unit shall be provided with dead front disconnect to remove power from protector for maintenance access. The disconnect should not be accessed from the front panel unless the unit meets the minimum clamp voltage requirements.
7. NEMA 12 Enclosure: 14 gauge steel, with stainless steel hardware.

PART 3 - EXECUTION

3.01 INSTALLATION AND MAINTENANCE

A. The unit shall be factory installed in the motor control center by the Motor Control Center manufacturer, in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. Units shall be installed as close as possible to the load side lugs of the transfer switch to which it is connected using low impedance Micro-Z cabling.

C. A 3-pole disconnect shall be provided to insure safety of maintenance personnel.

3.02 TWENTY YEAR WARRANTY

A. Manufacturer to provide twenty (20) year warranty to cover repair or replacement with a new device. Manufacturer to provide no cost replacement of fused protection modules for the life of the suppressor.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Dry type transformers.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

B. NEMA ST20 - Dry Type Transformers for General Applications.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA and impedance ratings and characteristics, tap configurations, insulation system type and rated temperature rise.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Dry type transformers shall be manufactured by General Electric Type QL.

B. Approved equal.

2.02 EQUIPMENT REQUIREMENTS

A. Three-phase and Single-phase general purpose dry type transformers be self-cooled, with ratings (KVA) as indicated on the drawings.

B. Shall meet or exceed DOE 2016 efficiency requirements.

C. Copper windings.

D. Sound levels not to exceed the following:
   1. 0-9 KVA: 40 db.
   2. 10-50 KVA: 45 db.
   3. 51-150 KVA: 50 db.
   4. 151-300 KVA: 55 db.
   5. 301-500 KVA: 60 db.
   6. 501-700 KVA: 62 db.

E. Three-phase transformers rated above 15 KVA to be insulated with UL listed Class 220 rated materials; and have a maximum average full load temperature rise of 115 degrees C.

F. Transformers to have voltage ratios as indicated on drawings. Transformers between 15 KVA and 300 KVA to be provided with six 2-1/2% full capacity taps, two above and four below primary rated voltage.

G. Nameplate: Include transformer connection data.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install transformers in accordance with manufacturer's recommendations.

B. Provide both primary and secondary protection as shown on drawings.

C. Set transformer plumb and level.

D. Provide grounding and bonding in accordance with provisions of Section 260526.

3.02 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltage and make appropriate tap adjustments.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Switchboards.

1.02 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Include electrical ratings, dimensions, mounting, material, running overcurrent protection, branch circuit overcurrent protection, wiring diagrams and accessories.

C. Provide detailed scaled 1/2" = 1'-0" drawings of switchboard including any and all instrumentation and control drawings on 24 inch x 36 inch blueprints for floor plans showing switchboard layout, locations and clearances.

D. Provide detailed scaled 3/4" = 1'-0" elevation drawings of switchboard including instrumentation and controls. Elevation drawings shall show all switches, circuit breakers, transfer switches, CT area, power monitors, etc., scaled locations of all knockouts and cutouts on exterior of enclosures for review and approved by Engineer.

E. Provide detailed scaled 3/4" = 1'-0" elevation drawings of switchboard including instrumentation and controls for interior mounting of all equipment. Drawings shall show all protective devices, circuit breakers, fuses, wiring, timers, terminal blocks and cable connection points.

F. Provide catalog cuts for each device including pilot lights, switches, timers, circuit breakers, fuses, meters, protective devices, etc.

1.03 REFERENCES

A. National Electrical Manufacturers Association (NEMA) - No. ICS-1, General Standards for Industrial Control and Systems; No. ICS-2, Industrial Control Devices, Controllers and Assemblies; No. ICS-6, Enclosures for Industrial Control and Systems.

B. ANSI 61

C. ANSI/NEMA PB 2, Deadfront Distribution Swithboards

D. ANSI/NEMA PB 2.1, General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less

E. ANSI/NFPA 70 - National Electrical Code.

F. NEMA AB1, Molded Case Circuit Breakers and Molded Case Switches

G. UL 489, Molded Case Circuit Breakers and Circuit Breaker Enclosures

H. UL 98, Enclosed and Dead Front Switches

I. UL 977, Fused Power Circuit Devices

J. ASTM D 178 - Specification for Rubber Insulating Matting.

K. Underwriters Laboratories, Inc. (UL) - No. 891, Switchboards.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. EATON POW-R LINE XPERT

B. Specifically Approved Equal. Substitute manufacturers shall be responsible to meet the exact dimensions detailed on the drawings. Switchboard manufacturer shall provide applicable U.L. labeling for all sections shown on drawings and for complete installation of all equipment specified to be packaged into the Switchboard. All equipment specified to be installed in Switchboard shall be factory installed by Switchboard manufacturer. No exceptions.

2.02 SWITCHBOARDS

A. Switchboards shall be in accordance with UL, NEMA, NEC and as shown on the Drawings.

B. Switchboard center is based on EATON POW-R LINE XPERT dimensions. Contractor shall be responsible to meet dimension requirements if substitution is proposed.

C. Switchboard shall be complete, floor mounted, metal enclosed, grounded, indoor type. The switchboard shall be NEMA Standard, Class 11, Type C except where other NEMA Standard classes and types are shown on the Drawings.

D. Ratings shall be 100,000 AIC for all switchboards with 100,000 AIC for Main Circuit Breaker.

E. Shall conform to the arrangements and details of the Drawings and to the spaces designated for installation.

F. All switchboard doors shall be removable with a wiring plug harness for quick removal of doors with disconnecting wire terminations.

G. Design the switchboard to withstand the mechanical stresses caused by rough handling during shipment in addition to the electrical and mechanical stresses which will occur during operation of the switchboards.

H. Coordinate components of the switchboards and their arrangements electrically and mechanically. The components and the control wiring shall conform to the approved shop drawings as furnished for the various applicable electrical and mechanical sections of the specifications.

I. Assemble, connect and wire the switchboards at the factory in accordance with the NEMA Standard class and type for each switchboard.

J. Thoroughly clean, phosphatize and paint the metal surfaces at the factory with primer and baked enamel or lacquer finishes.

K. Switchboard shall have the following features:
   1. Standard Vertical Sections:
      a. Approximately 90 inches high, front and rear line-up, fabricated by a single manufacturer.
      b. Rugged steel assemblies with bracing, reinforcing gussets and jig-welding to assure rectangular rigidity. The sections shall be completely metal-enclosed, including their bottoms.
      c. Steel shall not be less than code gauge, leveled.
      d. Bolts, nuts and washers shall be rustproof metal.

e. Spaces within the sections shall be suitable and adequate.
f. Mount the sections on adequate structural steel supports at the factory, front and rear, for the full length of each center. Install the centers so the supports will rest on top of the concrete floor surfaces except where concrete pads are indicated. Anchor the centers with bolts, not less than 1/2-inch diameter.
g. End panels shall be screw-removable to facilitate future additions.
h. Removable panels shall have screws which remain in the panels when the panels are removed. Screws shall be received by self-aligning, self-retaining nuts attached within the assemblies.

2. Bus Bars and Interconnections:
   a. Shall be copper, rated as indicated on drawings. Minimum size shall be 2000____ amps and shall adhere to all other applicable codes having jurisdiction.
   b. Shall be totally enclosed with all spacing as required by all applicable codes having jurisdiction.
   c. Bus bar joints and interconnection joints shall be plated with silver, tin, nickel or cadmium, constant high-pressure type with high strength copper-silicon bolts and nuts.
   d. Insulation:
      1) High strength polyester glass or equal.
      2) High track-resistance.
      3) High impulse and dielectric strength, especially at elevated temperatures, for withstanding the maximum short circuit currents.
      4) High flame-retardant, self-extinguishing.
      5) NEMA Standard for 65°C temperature rise shall apply.
   e. Shall have horizontal main buses and vertical buses for connecting the circuit breakers and switches.
   f. Shall have an adequate ground bus that extends across the entire width of each center.
   g. Bus bars shall be designed to extend to additional sections when so shown on the Drawings in addition to extending through dead corner cubicles.
   h. Temperature rises shall not exceed the NEMA Standards.
3. Completely equipped spaces for future circuit breakers and switches.
4. Identify each circuit breaker, switch or other device with a separate nameplate of laminated black phenolic resin with white core and engraved lettering not less than 3/16-inch high. Identify each device by its name or other designation as indicated in drawings.

L. Test the switchboard at the factory to assure that the switchboards do not have any defects. Additional “spot” testing such as contact resistance shall be conducted at bus connections between switchboard sections installed at the site.

M. Electrical Matting: Dielectric strength 30,000 volts, 3 feet wide, 1/4 inch thick corrugated ASTM D 178 Type 2, Class II.

N. All circuit breakers shall be rated 100,000 AIC. AIC based on stand alone ratings. Manufacturers rating using combined systems ratings to use lower AIC rated breakers is not acceptable.

O. Main Protective Device - Eaton Power Defense Molded Case Breaker, Fixed Mount Main (For breaker 1200A and above)
   1. Circuit breakers shall comply with the requirements of UL. Breakers shall be three-pole, 100% rated type or approved equal.
      a. Circuit breaker element shall have spring charged/discharged indicators and circuit breaker open or closed and ready to close indicators all of which shall be visible to the operator with the compartment door closed.

   b. Provide interlocks to prevent racking the circuit breaker unless the breaker is open.
2. Ratings: Interrupting up to 100 kA at 480V without fuses. Short time current ratings for each circuit breaker shall be as indicated on the drawings or data tables. Circuit breakers shall be 600-volt class.
3. Operating Mechanism: Mechanically and electrically trip-free, stored-energy operating mechanism with the following features:
   a. Normal Closing Speed: independent of both control and operator.
4. Each low voltage circuit breaker shall be equipped with self-powered, microprocessor-based trip-device to sense overload and short circuit conditions. The device shall measure true RMS current. The tripping system shall consist of high accuracy (<1%) Rogowski coil sensors on each phase, a release mechanism and the following features:
   a. Field Installable and interchangeable front mounted trip units. Trip units can be upgraded for future expansion in functionality, such as communication.
   b. Functions: Long time, short time and extended instantaneous protection function (EIP) shall be provided to allow the breaker to be applied at the withstand rating of the breaker with minus 0% tolerance so that there is no instantaneous override whatsoever. This feature shall furthermore allow the circuit breaker to be applied up to the full instantaneous rating of the breaker on systems where the available fault current exceeds the breakers withstand rating. Each shall have an adjustable pick-up setting. In addition, long time and short time bands shall each have adjustable time delay. Short time function shall include a switchable I2t ramp.
   c. A software program shall be made available free of charge to support system coordination studies. The software will allow time current curves to be generated for the chosen settings.
   d. Individual LED’s shall indicate an overcurrent, short circuit or ground fault trip condition.
   e. Time-current characteristics shall be field adjustable locally or optionally remotely via a bus system Ethernet.
   f. Current Adjustability shall be accomplished by use of dial settings and rating plugs on trip units. The rating plug shall be front mounted and upgradeable. Upgrades to the rating plugs shall not require changes to the CT.
   g. Pickup Points: 10 Long Time Settings.
   h. Field Installable Ground-fault protection with at least three time-delay bands and an adjustable current pickup and an I2t ramp. Arrange to provide protection for four-wire service.
   i. Field Installable Communications and metering functions shall be provided per schedule.
   j. A LCD display shall be available to simplify settings & viewing data locally.
   k. The option to remotely switch protection settings shall be provided whenever a generator is part of the power distribution system.
   l. Field installable configurable [analog], [digital] output relays shall be available to connect directly to the trip unit.
   m. Waveform capture and display shall be accomplished on the trip units LCD display.
5. Terminal Block Connections, shall be front mounted and utilize Screw Type Terminals.
6. Control Switch: One for each electrically operated circuit breaker.
7. Undervoltage Trip - field installable: Adjustable time-delay.
8. Indicating Lights: To indicate circuit breaker is open or closed, for electrically operated circuit breakers.
9. Accessories shall be front mounted.
10. Portable lifting yoke for drawout circuit breakers.
11. Field interchangeable accessories shall include CT’s, trip units, racking mechanism and all internal & external accessories.
12. The main breaker shall have a Dynamic Arc Flash Sentry. The main breaker shall have a dual protective setting capability with graphic waveform display, similar to the Siemens WL

breakers ETU776 trip unit. The main breaker will allow the installer to set two different trip curves into one breaker. One curve will be set for standard operating mode and the second curve, with instantaneous protection shall be set for arc flash mode. The switchboard shall be outfitted with a 24 VDC power supply, CubicleBus digital input module, annunciator panel with flashing light and a UPS power supply. The arc flash mode shall be actuated by a keyed. The breakers with frames rated 1200 amps or higher shall be equipped with Dynamic Arc Flash Sentry to comply with NEC 2014 240.87.

2.03 POWER MONITOR

A. Manufacturer: ACCUENERGY
   1. Model No: ACUVIM II Series.
   2. 480 volt.

B. Quantity: One (1) required, 480V, 3 phase 4w.

C. Provide current and potential transformers for all three phases and neutral for digital ammeters/voltmeters.

D. The power monitor shall incorporate a vacuum display and keypad to allow the user to read the following parameters:
   1. Voltage V1, V2, V3.
   2. Current I1, I2, I3, In, Iavg.
   3. Power P1, P2, P3, Psum.
   4. Reactive Power Q1, Q2, Q3, Qsum.
   5. Apparent Power S1, S2, S3, Ssum.
   6. Frequency.
   7. Power Factor.
   8. Energy.
   9. Reactive Energy.
   10. Apparent Energy.
   11. Demand.
   12. Load Features.
   13. Four Quadrant Powers.
   14. Power Quality.
   15. Voltage Harmonics.
   16. Current Harmonics.
   17. Voltage Crest Factor.
   18. Current K Factor.
   19. Voltage Unbalance Factor.
   20. Current Unbalance Factor.
   21. Max/Min Statistics with Time Stamps.

E. Power monitor shall have the following features:
   1. Alarms
   2. I/O Option Module
   3. Anti-tampering Seal
   4. Data Logging (8mb)
   5. Automatic Frequency adaption.
   6. Power Quality Event Logging.
   7. Communication
      a. Modbus RTU Protocol and DNP 3.0 via RS485
      b. Ethernet (Modbus TCP, HTTP, SMTP, SNTP)
      c. Profibus DP
      d. BACnet IP, BACnet MS/TP

e. Dual RS485 Communication Ports

8. 0.2% accuracy.

F. Power monitors shall be factory installed on the Switchboard enclosure doors as indicated on drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide and install concrete housekeeping pad as shown on drawings

B. Provide and install electrical matting to extend 24 inches beyond end of switchboard. Cut matting clear of obstructions.

C. Shop inspect and test switchboard in accordance with NEMA PB 2.

D. Make completed switchboard available for inspection at manufacturers factory prior to packaging for shipment. Notify Owner at least seven (7) days prior to inspection.

E. Allow witnessing of factory inspections and tests at manufacturers test facility. Notify Owner at least seven (7) days before inspections and tests are scheduled.

3.02 INSTALLATION

A. Install switchboard in location as indicated on contract drawings in accordance with NEMA, NEC and manufacturer's instructions.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch.

D. Meter pans, meters, current transformers, and ground fault protection (where applicable) shall be factory installed into switchboards as per local utility specifications.

3.03 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

B. Tighten bolted bus connections in accordance with manufacturers instructions.

C. Adjust circuit breaker trip and time delay settings to values as indicated by Architect/Engineer in field.

3.04 SOURCE QUALITY CONTROL

A. Provide Owner and Architect/Engineer with a copy of all test records.

B. Provide Owner and Architect/Engineer with Operations and Maintenance Manual prior to contract closeout.

C. Touch up scratched or marred surfaces to match original finishes.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Distribution panelboards.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

B. NECA Standard of Installation.

C. NEMA AB1 - Molded Case Circuit Breakers.

D. NEMA PB1 - Panelboards.

E. NEMA PB1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

F. NEMA ICS2 - Industrial Control Devices, Controllers and Assemblies.

G. NEMA KS1 - Enclosed Switches.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. New Panelboards
   1. Panelboards shall be manufactured by Eaton.
   2. Approved equal.

2.02 PANELBOARD REQUIREMENTS

A. Provide panelboards of circuit breaker, dead-front safety type, UL labeled, and meeting all applicable requirements of the National Electrical Manufacturers Association.

B. Provide panelboards with lugs (both main lugs and branch circuit lugs) suitable and UL approved for both aluminum and copper conductors.

C. Provide electrically isolated neutral bars.

D. Provide separate ground bars complete with lugs or connectors on bar.

E. Provide key operated door and door lock. Door shall prevent access to operate circuit breakers.

F. Provide panelboards with sequence phased bus bars or distributed phase bussing for voltage and phase as indicated on drawings.

G. Refer to drawings for numbers of branch circuits, their ratings, number of poles, arrangements, etc.

H. Provide typed circuit directory cards.

I. Provide front filler plates for unused breaker knockouts.

J. Refer to drawings for Ratings and Features.

K. All bus bars, including ground bars shall be tin-plated copper.

L. All circuit breakers shall be bolt-on type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground separate ground bars to panel boxes and to the main service entrance ground bus with a code-sized grounding conductor installed in the same conduit as the phase and neutral conductors under provisions of Section 260526.

B. Install all circuits using a common neutral bus bay in accordance with the National Electric Code. Balance all circuits to achieve not greater than 7% unbalanced neutral current in panel feeders.

C. Provide six circuit breaker handle lock-on devices for each lighting and miscellaneous power panelboard for installation by the contractor on circuits as directed by the Engineer to prevent unauthorized personnel from turning off circuits to controls, unit heaters, autodial alarm system, etc. Provide spare lock-on devices over to the Engineer.

D. Install panelboards in accordance with NEMA PB 1.1.

E. Install panelboards plumb.

F. Height: 6 feet (2 m) to top of panel board.

G. Provide typed circuit directory for each branch circuit panelboard. Handwritten circuit directory cards will not be accepted. Revise directory to reflect circuiting changes required to balance phase loads.

H. Provide a typed circuit directory in accordance with NEC sections 110.22 and 408.4. Circuits shall be labeled with detailed information describing the switches function and equipment location.

I. For all existing circuits terminated to a new panelboard, contractor shall trace out and update the circuit directory in accordance with NEC sections 110.22 and 408.4. Include all costs for this work in base bid.

J. Revise directory to reflect circuiting changes required to balance phase loads.

K. Provide engraved plastic nameplates under the provisions of Section 260553.

3.02 FIELD QUALITY CONTROL

A. Maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Switches, receptacles, device plates and other wiring devices as indicated on Drawings.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

B. NEMA WD1 - General Purpose Wiring Devices.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Provide manufacturer's catalog information showing dimensions, colors and configuration.

1.04 REGULATORY REQUIREMENTS

A. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.01 SWITCHES

A. Manufacturers: HUBBELL, LEGRAND, GENERAL ELECTRIC.

B. Single pole, 20 amp, 120/277 VAC, NEMA WD-1, heavy duty, UL20.

C. Device Plate: Coordinate face plate color with District.

2.02 RECEPTACLES

A. Manufacturers: HUBBELL, LEGRAND, GENERAL ELECTRIC.

B. 20 amp, 125 VAC, NEMA WD-1, heavy duty.

C. 20 amp, 125 VAC, NEMA WD-1, heavy duty, ground fault circuit interrupter.

D. Duplex type.

E. Device Plate: Coordinate face plate color with District.

F. Tamper-Resistant Receptacles

2.03 MANUAL MOTOR RATED THERMAL SWITCH

A. Acceptable Manufacturers: SQUARE D, Class 2510, Type KG1A, Type KG2C (3-pole, 600V) or approved equal.

B. Contractor shall coordinate voltage, phase and current rating with equipment.

2.04 TELEPHONE/DATA OUTLETS

A. Provide combination telephone/data jacks compatible with RJ-45 cable connections.

B. Provide “Decora” type with matching vinyl cover plate.

C. Colors shall be selected by the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mounting:
   1. Mount all switches 46-inches above finished floor to center line of switch unless noted otherwise.
   2. Mount all receptacles 18-inches above finished floor to center line of receptacle unless noted otherwise.
   3. Install switches with OFF position down.

B. Polarity: Properly wire all receptacles so that the hot wire, the neutral wire and the ground wire connect to the proper terminal on all receptacles.

C. Grounding: Install all devices in boxes specified under Section 260533 and install a No. 12 green ground wire from device grounding terminal to the outlet box in accordance with the National Electric Code.

D. Install device plates on switch, receptacle and blank outlets in full contact with wall surface.

3.02 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Disconnect switches.

B. Fuses.

C. Enclosed Circuit Breakers.

1.02 REFERENCES

A. NEMA KS-1 - Enclosed Switches.

B. ANSI/UL 198C - High Intensity Capacity Fuses, Current Limiting Types.

C. ANSI/UL 198E - Class R Fuses.

D. FS W-S 865 - Switch, Box (Enclosed), Surface Mounted.

E. NEMA AB1 - Molded Case Circuit Breakers.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Include outlet drawings with dimensions and equipment ratings for voltage, capacity, horsepower and short circuit current ratings.

1.04 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

2.01 DISCONNECT SWITCHES

A. Disconnect switches shall be GENERAL ELECTRIC, heavy-duty Type TH or approved equal.

B. 75ºC conductor ratings.

C. Ratings: 600VAC

D. Quick-break, quick-make, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

E. Suitable for use as service entrance equipment.

F. UL listed for Class R 200,000 RMS amps, symmetrical IC.

G. Class R fusing kit.

H. Enclosures: Refer to drawings.

2.02 FUSES

A. Fuses shall be Littlefuse KLNR Class RK1 or approved equal.

B. Fuses shall be rated for 600 volts AC.

C. Interrupting Rating: 200,000 RMS amps.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Install molded case circuit breakers for Main Circuit Breaker, Generator Circuit Breaker and Panel Circuit Breakers.

B. Molded Case Circuit Breaker:
   1. Manufacturer: SIEMENS
      a. 125 Amp, 3 Pole Type ED6.
      b. 250 Amp, 3 Pole Type HFD6.
      c. 400Amp, 3 Pole Type HJD6.
      d. 600Amp, 3 Pole Type HLD6.
      e. 800Amp, 3 Pole Type HMD6.
   2. AIC Rating: 65,000 amperes.
   3. Thermal magnetic with interchangeable trip

C. Enclosure
   1. Manufacturer: SIEMENS
   2. Rating: NEMA 1 (for interior use) or NEMA 4X Stainless Steel (for exterior use).
   3. External Throw.
   4. Suitable for Service Entrance Equipment (where applicable).

D. Main Protective Devices 1200A and Above shall be Siemens Type WL Insulated Case Breaker. The main breaker shall have a Dynamic Arc Flash Sentry. The main breaker shall have a dual protective setting capability with graphic waveform display, i.e. the Siemens WL breakers ETU776 trip unit or equal. The main breaker will allow the installer to set two different trip curves into one breaker. One curve will be set for standard operating mode and the second curve, with instantaneous protection shall be set for arc flash mode. The switchboard shall be outfitted with a 24 VDC power supply, CubicleBus digital input module, annunciator panel with flashing light and a UPS power supply. The arc flash mode shall be actuated by a keyed. The breakers with frames rated 1200 amps or higher shall be equipped with Dynamic Arc Flash Sentry to comply with NEC 2014 240.87.

2.04 EXTRA MATERIALS

A. Provide one complete set based on number of poles of spare fuses for each fused disconnect switch. Provide to Owner.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Removed temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Provide switches/enclosed circuit breakers at locations as indicated on drawings.

D. Refer to disconnect switch schedule on drawings for ampacity ratings, fuse sizes, number of poles and enclosure ratings.

E. Install fuses in fusible devices.

F. Install engraved nameplates on each switch and enclosed circuit breaker identifying the following:
   1. Switch designated.
   2. Load served.
   3. Power origination.
   4. Fuse size as indicated on drawings.

3.02 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.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior and exterior luminaries and accessories.

B. Emergency lighting and units.

1.02 REFERENCES

A. NEMA WD 6 - Wiring Devices - Dimensional Requirements.

B. NFPA 70 - National Electric Code (2014).

C. NFPA 101 - Life Safety Code.

D. LM-79-08, IESNA Approved Method for the Electrical and Photometric Measurements of Solid-Sate Lighting Products

E. LM-80-08, IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources

F. NYECC and ASHRAE 90.1.

G. UL924: Emergency Lighting and Power Equipment; Current Edition. Including All Revisions.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, performance data and installation instructions.

D. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

E. All foot candle calculations and photometrics must be provided with substitute products. Photometrics shall include a room by room analysis showing walls, room names and room numbers. Calculation points shall be 2 feet on center, measured at 30" above the floor. Maintained foot candle levels shall meet or exceed those listed in Section 2.03A of specification 265000. On each drawing, provide a table showing the Room Name, Room Number, Maximum Light Level, Minimum Light Level, Average Light Level, Min:Max Ratio and, IES File Model Number.

F. All substitute LED light fixtures and LED retrofit lighting kits must be Design Lights Consortium (DLC) qualified.

G. All substitute LED replacement lamps must be listed by Energy Star as Certified Light Bulbs.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc.

1.05 EXTRA PRODUCTS

A. Section 017800 - Closeout Submittals.

B. LED Fixtures: At completion of installation, deliver to Owner.
   1. 10% of each light fixture type as shown on light fixture schedule with one (1) being the minimum.

PART 2 - PRODUCTS

2.01 LIGHTING UNITS

A. Refer to LIGHTING FIXTURE SCHEDULE on drawings for fixture manufacturer, catalog number, and fixture description.

B. Provide electronic energy saving drivers. Where dimming is shown on drawings, provide dimmable type drivers.

C. All fixtures equipped with emergency battery packs shall have test light and switch accessible and visible from the room floor.

D. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes and listed and labeled as complying with UL 924.

2.02 LIGHTING FIXTURE NOTES

A. MOUNTING: Electrical Contractor is responsible for reviewing all mounting arrangements prior to ordering any products. Electrical Contractor is responsible for ordering all of the proper fixtures, mounting hardware and miscellaneous fasteners to complete project. Fixtures to be secured to the structure from a minimum of two points, at opposing ends of the fixture when ceiling recessed or surface mounted. Four points shall be secured where necessary for the fixture to be parallel and tight to underside of ceiling. All recessed fixtures to fit tight to ceiling to eliminate all light leaks. Trim kits, when not secured internally to fixture, shall be secured to structure at a minimum of two points.

B. MOUNTING: Prior to submitting and ordering any light fixture, Contractor is responsible for verifying adequate mounting clearances for all light fixtures that are to be recessed into a grid type ceiling. Where new ceilings are to be installed, contractor shall coordinate with ceiling installers for exact mounting heights and required mounting spaces.

C. FINISHES: All exposed portions (permanent or adjustable) of fixtures to be finished by the manufacturer in a finish as specified.

D. Fixtures shall come pre-assembled and complete with all sockets (incandescent to be spring supported), lamp ends, ballasts, transformers, fixture ends, trim rings, plates, and low density mounting kits (as required) for a complete installation.

E. LENSES:
   1. Minimum 0.125” thick and to be virgin acrylic.
   2. Low voltage - Tempered glass, to enclose lamp.

F. VOLTAGE: As noted on the LIGHTING FIXTURE SCHEDULE. Contractor is responsible for field verifying available voltage(s) and ordering fixtures, ballasts, and transformers accordingly.

G. ORDERING: It is solely the responsibility of the Contractor to order fixtures, lamps, mounting brackets and accessories so that the fixtures will be installed and operating upon Owner Occupancy opening. Contractor is responsible for all delays because of his/her lack of effort to order the products in a timely manner.

H. SHIPPING: The light fixture manufacturer shall mark the fixture type as indicated on the contract drawings and/or shop drawings on the respective carton when shipping luminaries. The Contractor shall be responsible for checking each carton immediately upon receipt for verification that fixtures are undamaged and no contents are missing. All discrepancies must be reported to shipper and manufacturer immediately; otherwise the Contractor shall be responsible for items which are lacking or damaged.

2.03 SED REQUIRED LIGHT LEVELS

A. Requirements for maintained horizontal foot-candles for each location within each building are listed below. Confirm designated use of each “Location” with owner and engineer prior to beginning calibration work: **Light levels shall not drop below SED standard guidelines as shown in chart.**

Location	**Required Maintained Horizontal Foot-Candles**
Classrooms, study halls, and lecture rooms [on desks and tables]	30
Offices [on desks]	30
Libraries [on desks and tables]	30
Music rooms [on work]	40
Sewing rooms, drafting rooms, home economics [on work]	40
Shops, laboratories, and art rooms [on work]	30
Gymnasiums and playrooms	20
Cafeterias (on tables used for study)	30
Cafeterias (not used for study)	20
Auditoriums	10
Conference, meeting rooms	20
Corridors, stairs, passageways, interior means of egress, area of refuge	10
Locker rooms and toilets	10

B. Contractor shall program all fixtures as per district requirements.

C. Contractor shall calibrate fixtures as per district requirements.

2.04 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.05 WARRANTY

A. All light fixtures shall have a 5-year manufacturer's warranty. Warranty shall begin on date of substantial completion.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fixtures in accordance with manufacturer's instructions.

B. Mount fixtures in locations as shown on drawings and as called for in schedule on electrical drawings. Determine type of ceiling to be installed in each space from drawings and schedules and furnish fixtures suitable for the exact type.

C. Joints in fixture wiring shall be made using wire nuts, pre-insulated Scotch locks, or other approved mechanical means of connection.

D. Adjustable type fixtures shall be adjusted by the Contractor to illuminate intended area to satisfaction of the Engineer.

E. Surface fixtures in or on plastered or drywall ceilings shall be supported from pieces of support channel spanning across main support channels and shall not depend on ceilings for support.

F. Coordinate fixture locations to clear diffusers, ductwork, piping, etc.

G. Maintain integrity of enclosures on all enclosed and gasketed fixtures. Minimize number of enclosure penetrations and make such penetrations water and dust tight with appropriate gasketing and fittings.

H. Fixtures are to fit tight against construction to eliminate light leaks.

I. Recessed downlights are to be provided with adjustable mounting bars/frames for drywall or lay-in ceilings as required. Fixtures shall be securely fastened to the ceiling framing member by mechanical means such as bolts, screws, rivets, or listed clips identified for use with the type of ceiling framing members and fixtures.

J. Support recessed fixtures 2 foot x 2 foot and larger using a minimum of four independent wire hangers, one on each corner, of same gauge as ceiling suspension system supported from building structure independent of ceiling framing. Install earthquake clips to secure recessed grid-suspended luminaries in place.

K. Wall-mounted fixtures shall be mounted plumb with building lines and installed with proper box and cover hardware.

L. Surface-mounted fixtures are to cover mounting hardware. Use a canopy that is no longer than the length and width of the fixture and at a height that is no higher than required to mount the

fixture absolutely vertical. Fixtures shall be plumb and shall align with building lines and with each other. Support surface mounted luminaries on grid ceiling directly from building structure. Secure to prevent movement.

M. Stem-mounted fixtures are to be mounted to be absolutely vertical or horizontal. Install suspended luminaries using pendants supported from swivel hangers or in accordance with details shown in drawings. Provide pendant length required to suspend luminaire at indicated height. Support stem-mounted fixtures directly from the building structure.

N. Install recessed luminaries using accessories and firestopping materials to meet regulatory requirements for fire rating. In fire rated ceilings, recessed luminaries must carry one-hour UL fire rating classification.

O. Install all accessories specified with each fixture. Install recessed luminaries to permit removal from below.

P. Bond products and metal accessories to branch circuit equipment grounding conductor.

Q. At completion of installation and before turning over to owner, clean and remove all dirt and smudges from all lighting fixtures including lenses, louvers and reflectors.

R. Replace luminaries that have failed at completion of project.

S. Battery backup unit equipment emergency lighting shall be circuitred in accordance with NEC Article 700.12. Equipment on the same branch circuit as that serving the normal lighting in the area to be connected ahead of any local switches.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Main CB/current transformer/meter cabinet and meter pan.

B. Transformer to be mounted on a reinforced concrete pad/pull box.

C. Primary and secondary conduits, conductors, excavation, concrete and backfill.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 013300.

PART 2 - PRODUCTS

2.01 METERING EQUIPMENT

A. Meter pans, meter, current transformers and ground fault circuit protection shall be on Local Utility's approved lists of manufacturers and models.

B. CT Cabinets, Current Transformers and Ground Fault Protection shall be factory installed into motor control center manufacturer’s structures as per Local Utility specifications.

2.02 COMBINATION TRANSFORMER PAD/PULL BOX

A. Combination transformer pad/pull box shall be as per Local Utility requirements.

B. Conduit penetrations shall be provided for both primary and secondary penetrations into transformer and into pull box so that minimum ground cover is maintained in accordance with NEC and Local Utility requirements. Enter primary and secondary conduits/conductors into transformer pullbox in accordance with Local Utility requirements.

2.03 PULL BOXES

A. Provide pull boxes including property line pull boxes as per Local Utility requirements for both primary and secondary services.

B. Provide Local Utility approved type TS for all primary services and secondary services above 400 amperes.

C. Provide Local Utility approved type B-3-6 for secondary services 400 amperes and less.

2.04 CABLE

A. Install new primary and secondary service conductors in conduit.

B. Primary service conductors shall be 15 KV, copper size 1/0, type TR-XLPE with 220 mils insulation thickness as per Local Utility requirements.

C. Secondary service conductors shall be copper type XHHW-2 as per Local Utility requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate primary and secondary service installation with Local Utility prior to beginning work.

B. Provide secondary service to incoming cubicle of motor control center, coordinate service requirements with Local Utility prior to commencing work.

C. Contractor shall file application for new electrical service. Contractor shall coordinate with owner for all information related to the service application.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Temporary electric service for construction.

1.02 REFERENCES

A. ANSI/NFPA 70 - National Electric Code.

1.03 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Shop Drawings: Indicate locations where temporary electric service will be located and routed.

1.04 REGULATORY REQUIREMENTS

A. Obtain required permits from authorities.

B. Notify affected utility companies before starting work and comply with their require-ments.

C. Do not close or obstruct egress width to exits.

D. Do not turn off electric equipment without authorization from Owner and Engineer. Provide 72 hours advance notification.

PART 2 - PRODUCTS

2.01 TEMPORARY ELECTRIC SERVICE

A. Temporary service shall be available during the entire contract period and during all phases of work, day and night for new addition.

B. Temporary service shall be installed and maintained per NEC, OSHA, N.Y. State Uniform Building Code and Local Utility requirements.

C. The temporary electrical service shall be sized correctly for all of the new and existing loads.

D. All existing equipment shall be protected against damage caused by the installation, operation and removal of the temporary service. Any equipment or items damaged shall be replace at no cost to the Owner.

E. Provide temporary lighting for new addition. Minimum foot candle for temporary lighting: 30 F.C., measured at floor surface. The Contractor shall set up light to minimize glare.

F. Provide wiring, utility poles, metering equipment, distribution panel and other equipment for temporary light and power to new addition. Contractor shall pay all fees required for temporary service and complete all required applications. Contractor shall pay all application and construction fees required for temporary service and complete all required applications. Contractor shall pay for all electrical consumption for temporary service.

G. Provide Owner with three (3) keys to all distribution panels for temporary power for distribution to General Contractor and District Personnel.

H. Wiring for temporary light, controls and power shall include a distribution panel for 4 wire, 120/240 volt, 200 AMP service. Feeders in building shall have branch circuits of #12

conductors minimum. Contractor shall pay all application and construction fees required for temporary service and complete all required applications

I. Provide 20 amp branch circuits with fused ground type receptacle outlet for single phase power.

J. Where distribution panels are provided for temporary power provide four (4) 20 amp circuits with #12 AWG SO cord pigtails with 20 amp plugs with strain relief. Provide one (1) 30 amp circuit with #10 AWG SO cord pigtail with 30 amp plug with strain relief.

K. Provide lamps and fuses, including replacements required.

L. Provide new materials for temporary light and power.

M. Provide ground fault protection (such as portable plug-in type ground fault circuit interrupters) on single phase 20 amp receptacle outlets.

N. Provide receptacle outlets, portable cord connectors and attachment plugs with standard NEMA configurations.

O. Install all temporary light and power materials in accordance with National Electrical Code.

P. Upon completion of the project, remove all temporary electric light and power work and restore all affected finishes, connections and sitework.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing system voltage characteristics and match to existing system voltage characteristics.

B. Verify that the temporary service is sized to accommodate all loads.

C. Determine locations and routings for temporary electric wires, cables and conduits with Engineer and Owner.

3.02 TEMPORARY POWER

A. Temporary wiring and power shall be installed so as not to be a hazard and shall be protected from damage. Separate circuits shall be provided for light and power. Over-current protective devices and switches shall be provided. All equipment, tools, metal cabinets and boxes shall be grounded.

B. Disable existing power only to make final connections or when new service is to be installed.

C. Remove and dispose of all temporary power and control feeds after receiving written approval from Engineer. Restore all finishes to original specified conditions.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire Alarm Control Panels (FACP).

B. Remote Annunciator.

C. Addressable Manual Fire Alarm Stations.

D. Addressable Area True Alarm Smoke Detectors.

E. Addressable Duct Mounted Smoke Detectors.

F. Remote for Smoke Alarms.

G. True Alarm Heat Sensor.

H. Audio/Visuals

I. Visual Devices

J. Pull Stations

K. Addressable Carbon Monoxide Detection and Alarm

1.02 REFERENCES

A. NFPA 70 – National Electrical Code.

B. NFPA 72, 72G, 72H – National Fire Alarm Code.

C. NFPA 101 – Life safety code.

1.03 WORK INCLUDED

A. Furnish and install as described in these specifications and as indicated on the drawings, fire alarm and smoke detection equipment with battery backup.
   1. All equipment shall be UL listed under category UOJZ as an integrated control system; equipment listed under category UOXX as a control unit accessory shall not be acceptable. The installation shall meet the applicable requirements of NFPA 72 and New York State Code, as well as those standards set by the authorities having jurisdiction.
   2. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component. The catalog numbers specified under this section constitute the type, product quality, material and desired operating features.
   3. Provide all labor, materials and services to perform all operations required for the complete installation and related work shown on the drawings and as specified herein.
   4. All electrical work and equipment shall meet the requirements of NFPA 70 and 72.
   5. Existing fire alarm system to be disconnected and removed in its entirety once new system is installed, operational and tested. Contractor to patch and paint all openings as a result of removed equipment. Contractor to provide and install new ceiling tiles to match existing where damaged or holes are left from removed equipment.

1.04 SUBMITTALS

A. Submit product data as required by Section 013300.
   1. Two copies of all submittals shall be submitted to the Architect/Engineer for review.
   2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.
   3. Equivalent equipment (compatible UL-Listed) from other manufacturers may be substituted for the specified equipment as long as the minimum standards are met, and upon approval of the Architect/Engineer.

B. Shop drawings:
   1. Provide a list (bill of materials) of all types of equipment and components provided.
   2. Provide annunciator layout and system wiring diagram showing each device and wiring connection required, including existing equipment. Provide a description of operation of the system. Provide system ampere load and time calculations to substantiate compliance with battery backup (24 hours in non-alarm condition followed by 5 minutes in alarm, after normal power loss)
   3. Sufficient information clearly presented shall be included to determine compliance with drawings and specifications.
   4. Include manufacturer's printed product data with name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.

C. Manuals:
   1. Submit simultaneously with the shop drawings, complete operating and maintenance manual listing the manufacturers name(s) including technical data sheets.
   2. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
   3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
   4. Indicate application conditions and limitations of use stipulated by product testing agency.
   5. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of products.

D. Test Reports and Certifications:
   1. Indicate satisfactory completion of required tests and inspections.
   2. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

E. Contractor shall provide Engineer with a complete set of drawings (including all floors, crawl spaces, closets, open spaces) showing a complete survey of all existing and new fire equipment devices and appliances prior to submission to Fire Marshal. Contractor shall provide Engineer with a complete list of all HVAC equipment to remain, including their associated CFM ratings and all associated duct smoke detectors. Upon approval from Engineer, Contractor shall submit complete package, with New York professional engineer's stamp, to Fire Marshal as per local requirements. The Contractor shall have a licensed New York State Professional Engineer stamp all drawings and applications, including submittals for approval from H2M. Pay for all fees to obtain permits and approval.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017839.

B. On as-built installation drawings: Record actual locations of initiating devices, signaling appliances, and end-of-line devices, including those that are existing.

C. Provide a written sequence of operation to the owner.

D. Provide site specific software and program, including all addressable points.

E. A completed NFPA 72 Inspection and Testing form shall be submitted to the owner, prior to system acceptance.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 017839.

B. Maintenance and testing shall be on a semiannual basis or as required by the Authority Having Jurisdiction (AHJ). A preventive maintenance schedule shall be provided by the Contractor that shall describe the protocol for preventative maintenance. The schedule shall include:
   1. Systematic examination, adjustments and cleaning of all detectors, manual fire alarm stations, control panels, power supplies, relays and all accessories of the fire alarm system.
   2. Each circuit in the fire alarm system shall be tested semiannually.
   3. Each smoke detector shall be tested in accordance with the requirements of NFPA 72 Chapter 7.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum tem (10) years documented experience, and with service facilities within fifty (50) miles of project location.

B. Installer: Company specializing in installing the products specified in this section with minimum three (3) years documented experience, and certified by the State of New York as fire alarm installer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Honeywell

B. Approved equal.

2.02 GENERAL

A. All equipment and components shall be new, and the manufacturer’s current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approval agency for use as part of a protected premises protective signaling (fire alarm) system.

B. All equipment and components shall be installed in strict compliance with manufacturers’ recommendations. Consult the manufacturer’s installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning equipment installation.

C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.03 CONDUIT AND WIRE

A. Conduit:
   1. Conduit shall be in accordance with the National Electric Code (NEC), local and state requirements.
   2. All wiring shall be installed using plenum rated cable except for boiler, mechanical and electrical rooms and any other rooms with open ceilings.
   3. Cable must be separated from any open conductors, as per NEC Article 760-29.
   4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals
   5. Conduit shall enter the Fire Alarm Control Panel, Remote Annunciator Panel and/or backboxes where conduit entry is designated and permitted by the FACP manufacturer.
   6. Conduit shall be ¾ inch (19.1 mm) minimum.
   7. In finished areas where conduit cannot be concealed, surface mounted raceway is to be used.

B. Wire:
   1. All fire alarm system wiring shall be new.
   2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760), and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for Initiating Device Circuits and Signaling Line Circuits, and not less than 14 AWG (1.63mm) for Notification Appliance Circuits. All wiring shall be of the type recommended by the manufacturer.
   3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
   4. All wire and cable shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 and shall test free from grounds or crosses between conductors.
   5. Wiring used for the multiplex communication loop shall be twisted and shielded and installed in conduit unless specifically excepted by the fire alarm equipment manufacturer. The system shall permit use of IDC and NAC wiring in the same conduit with the communication loop.
   6. All field wiring shall be completely supervised.

C. Terminal Boxes, Junction Boxes and Cabinets:
   1. All boxes and cabinets shall be UL listed for their use and purpose.

D. Circuits shall be arranged to serve like categories (manual, smoke, horn, strobe). Mixed category circuitry shall not be permitted except on signaling line circuits connected to addressable reporting devices.

2.04 SEQUENCE OF OPERATIONS

A. Basic Addressing and Circuiting Guidelines
   1. The addressable fire alarm system shall provide an individual multiplex data address for each addressable manual fire alarm station, addressable area smoke detector, addressable duct smoke detector, addressable heat detector, Monitor Zone Addressable Module (MZAM), Control Zone Addressable Module (CZAM) or Signal Zone Addressable

Module (SZAM). The FACP shall be able to support up to a system total of two hundred fifty-four (516) individual addresses.

2. The FACP shall provide NFPA Standard 72A, Style 4 (Class B, two wire) addressable data communications circuits (MAPNET) to provide connection of and communication with the addressable devices, as required by these Specifications and/or as shown on the Drawings. Each addressable data communications circuit (MAPNET) shall provide the capability of communicating with up to one hundred twenty-seven (127) addressable devices.

B. Fire Alarm System Sequence of Operation

1. The FACP central processing unit (CPU) shall provide for the monitoring of addressable, smoke sensors. Each smoke sensor shall be individually monitored for its normal output voltage level, which is a function of accumulating environmental factors such as dirt and dust. The normal output voltage level shall be digitized and transmitted to the FACP CPU every four (4) seconds. The FACP CPU shall maintain a moving average of these normal voltage outputs in an individual sensor average file. When smoke enters the sensor, the output voltage rises in direct proportion to the density of the smoke and the alarm condition of each smoke sensor is determined at the FACP CPU by comparing the current actual value with the sensor's normal average value combined with the alarm threshold programmed for that sensor. The alarm threshold may be individually programmed for each smoke sensor as a sensitivity percentage (0.5%, 1.0%, 1.5%, 2.0%, 2.5%, 3.0% and 3.7%) above its normal average value. The sensitivity percentage for each sensor may also be programmed to change as a function of the time of day and day of week. When an individual sensor's normal average value rises to a fixed, preset level due to excess accumulation of dirt and dust, a system trouble condition shall be generated and a "sensor dirty" message shall be displayed, for that sensor, on the FACP LCD display and entered into the system historical trouble log. If the sensor is not cleaned and further accumulation occurs that would degrade proper sensor operation, a second system trouble condition shall be generated and a "sensor excessively dirty" message shall be displayed and entered into the system historical trouble log.
2. Operation of any manual fire alarm station or activation of any smoke sensor, area smoke detector, duct smoke detector, or heat detector throughout the building shall automatically:
    a. Sound all horns (except the exterior sprinkler horn/strobe) throughout the building with an individual Temporal ‘3’ Code. The alarm signals may be silenced during the alarm condition by operation of the FACP alarm silence switch. Subsequent alarm conditions shall re-sound the alarm horns.
    b. Flash all alarm strobe lights (except the exterior sprinkler horn/strobe) throughout the building. The alarm strobe lights shall be turned off when the system is reset.
    c. Display a general alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD). Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "alarm" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the alarm condition is reset to normal.
    d. Enter the alarm condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
    e. Shutdown all fans over 1000 CFM.
    f. Release Magnetic Door Hold Opens.
    g. Recall elevator
        1) When elevator machine room smoke detector and/or smoke detector adjacent to basement elevator door is activated, elevator shall recall to the first (second) floor.

2) When smoke detector adjacent to first floor elevator door is activated, elevator shall recall to the second floor (basement).
3) When smoke detector adjacent to second floor elevator door is activated, elevator shall recall to the first floor (basement).

h. Activate circuit for to initiate alarm to central station. The Central station monitoring shall be furnished by owner.

3. Operation of sprinkler waterflow switch shall automatically:
   a. Sound all horns throughout the building including the exterior sprinkler horn/strobe with an individual Temporal Code. The alarm signals may be silenced during the alarm condition by operation of the FACP alarm silence switch. Subsequent alarm conditions shall resound the alarm horns.
   b. Flash all alarm strobe lights including the exterior sprinkler horn/strobe throughout the building. The alarm strobe lights shall be turned off when the system is reset.
   c. Display a general alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD). Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "alarm" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the alarm condition is reset to normal.
   d. Enter the alarm condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
   e. Shutdown all fans over 1000 CFM.
   f. Release Magnetic Door Hold Opens.
   g. Recall elevator
      1) When elevator machine room smoke detector and/or smoke detector adjacent to basement elevator door is activated, elevator shall recall to the first (second) floor.
      2) When smoke detector adjacent to first floor elevator door is activated, elevator shall recall to the second floor (basement).
      3) When smoke detector adjacent to second floor elevator door is activated, elevator shall recall to the first floor (basement).
   h. Activate circuit for to initiate alarm to central station. The Central station communicator and central station shall be furnished by owner.
4. Operation of sprinkler tamper switch shall automatically:
   a. Display a general trouble indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD). Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "trouble" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the trouble condition is reset to normal.
   b. Enter the trouble condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
   c. Activate circuit for to initiate trouble to central station. The Central station communicator and central station shall be furnished by owner.
5. Operation of any carbon monoxide detector the building shall automatically:
   a. Sound the integral sounder base on the carbon monoxide detector in alarm only, with an individual Temporal ‘4’ Code. The alarm signals shall only be silenced when carbon monoxide detector is no longer in alarm.

b. Display/sound an alarm indication and system status summary (numbers of alarm, supervisory and/or trouble conditions) on the FACP liquid crystal display (LCD) stating “Carbon Monoxide Alarm”. Pressing the alarm acknowledge key shall display, for thirty (30) seconds, the individual device or circuit display, to include the "alarm" status and custom label (up to forty characters and spaces) for the addressable device or circuit of alarm initiation on the liquid crystal display (LCD). At the end of the thirty (30) second period, the general alarm indication and system status summary shall again be displayed. The individual device/circuit display may be recalled at any time by repressing the alarm acknowledge key or until the alarm condition is reset to normal.
c. Enter the alarm condition custom label with time and date of occurrence into the FACP historical alarm log for future recall.
d. Shutdown all fans over 1000 CFM.
e. Release Magnetic Door Hold Opens.
f. Recall elevator
    1) When elevator machine room smoke detector and/or smoke detector adjacent to basement elevator door is activated, elevator shall recall to the first (second) floor.
    2) When smoke detector adjacent to first floor elevator door is activated, elevator shall recall to the second floor (basement).
    3) When smoke detector adjacent to second floor elevator door is activated, elevator shall recall to the first floor (basement).
g. Activate circuit for to initiate alarm to central station stating “Carbon Monoxide Alarm”. The Central station monitoring shall be furnished by owner.

2.05 MAIN FIRE ALARM CONTROL PANEL

A. The fire alarm system control panel(s) shall be by Honeywell and comply with UL 864, "Control Units for Fire- Protective Signaling Systems."

B. The following FACP hardware shall be provided:
1. Power Limited base panel with beige cabinet and door, 20 VAG input power.
2. 2,000 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
3. 2000 points of annunciation where one (1) point of annunciation equals:
    a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
    b. 1 LED on panel or 1 switch on panel.
4. Provide battery voltage and ammeter readouts from the LCD Display.
5. Municipal City Circuit Connection with disconnect switch. 24VDC Remote Station (reverse polarity) local energy, shunt master box, or a form “C” contact output.
6. One Auxiliary Electronically resetable fused 2A @ 24VDC Output, programmable disconnect operation for 4-wire detector reset door release auxiliary use.
7. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay either as normally energized or ed-energized or as an auxiliary control.
8. Three (3) Class B or A (Style Y/Z) Notification Appliance Circuits (NAC: rated 3A @ 24VDC, resistive).
9. Four (4) form “C” Auxiliary Relay Circuits (Form C contacts rated 2A 24VDC, resistive), operation is programmable for trouble alarm, supervisory of other fire response functions. Relays shall be capable of switching up to ½ A @ 120VAC inductive.
10. The FACP shall support five (5) RS-232-C ports and one service port.
11. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
12. Common Event DACT or Point Reporting DACT.
13. Service Port Modem for dial in passcode access to all fire control panel information.

C. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to from a complete control unit, provide exactly matching modular unit enclosures.

D. Alphanumeric Display and System Controls: Panel shall include an 80-character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

E. Addressable Interface Module The addressable interface module(s) shall provide one (1) addressable data communications circuit (MAPNET) to enable the FACP to communicate with the addressable devices. Each addressable data communications circuit shall provide NFPA Standard 72A, Style 4 (Class B, two wire) supervised operation. Addressable data communications circuit wiring shall be supervised for opens in the circuit, shorts across the pair and ground faults. An addressable data communications circuit fault shall initiate a system trouble display and audible trouble signal at the FACP. Faults on one addressable data communication circuit shall not impede operation of other circuits. The module shall be readily disconnected for ease of servicing and shall be placement supervised by the Master Controller Module.

2.06 PERIPHERAL DEVICES

A. Shall be Honeywell series Addressable Single action type. Red LEXAN or metal, and finished in red with molded raised letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.

B. Protective Shield shall be Honeywell series with tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. VI/hen shield is lifted to gain access to the station. a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.

C. Wire guards to be Honeywell series. Wire Guards to be installed on all devices located in the gymnasium and locker rooms.

2.07 SMOKE SENSORS

A. Shall be Honeywell series Smoke Sensors and comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems," Include the following features:
   1. Operating Voltage: 24 VDC, nominal,
   2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation,
   3. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-Locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit,
   4. Each sensor base shall contain) LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the [detector head][sensor base] LED shall be on steady.
   5. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location,

6. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type, Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
7. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
8. Addressability. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
9. Removal of the sensor head for cleaning shall not require the setting of addresses.

B. Type: Smoke sensors shall be of the photoelectric type where acceptable per manufacturer specifications ionization type sensors may be used.

C. Duct Smoke Detector: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.
1. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C., contact rated at 7 A@ 28VDC or 10A@ 120V AC.
2. Duct Housing shall provide a relay control trouble indicator Yellow LED.
3. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
4. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke detector.
5. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
6. Each duct detector shall have a Remote Test Station with an alarm LED and test switch. Duct Smoke Sensor Shall be Simplex Model 4098-9755 Photoelectric type with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.
7. Duct Housing shall provide a relay control trouble indicator Yellow LED.
    a. Compact Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captivee fastening screws.
    b. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
    c. Duct Housing shall provide a magnetic test area and Red sensor status LED.
    d. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct: housing front cover.
    e. Each duct sensor shall have a Remote Test Station with an alarm LED and test switch.
8. All exterior duct detectors shall be provided with Simplex Model 4098-9845 Weatherproof Duct Housing Enclosure.

2.08 HEAT SENSORS

A. Shall be Honeywell series combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp: 135-deg F fixed-temperature setting except as indicated.

B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermostat-based, rate-compensated, self- restoring and shall not be affected by thermal lag.

C. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deq F to 155-deg F.

2.09 CARBON MONOXIDE SENSOR

A. Carbon Monoxide Detector (with integral fire detection) shall be Honeywell series, addressable carbon monoxide detector.

B. Each carbon monoxide detector shall also detect heat, smoke, and light/flame.

C. Each carbon monoxide shall be provided with a sounder base (sold separately).

D. When a carbon monoxide sensor is in alarm, that carbon monoxide sounder base only shall sound a ‘Temporal 4’ code pattern, an alarm shall sound at the panel, and central station shall be notified.

2.10 ANNUNCIATION DEVICES

A. Visible/Only Shall be Honeywell series and shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang or 4" square electrical box, without the use of special adapters or trim rings, and provide field selectable flash intensities of 15cd, 30cd, 75cd, 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific Visible/Only appliance.

B. Audible Visible shall be Honeywell series and shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe. The horn shall have a minimum sound pressure level of 85 dBA @ 24VDC. The audible/visible enclosure shall mount directly to standard single gang. double gang or 4” square electrical box without the use of special adapters or trim rings.

C. The strobes and speaker/strobes horn/strobes shall be compatible with the existing fire alarm control panel as stated in the installation manuals and be Listed with Underwriters Laboratories Inc. per UL 1971 and/or 1638.

D. The strobes and speaker/strobes horn/strobes shall be wall mounted to meet ADA requirements.

E. Weatherproof speakers shall be Honeywell series or approved equal and and listed for outdoor use under UL Standard 1480.

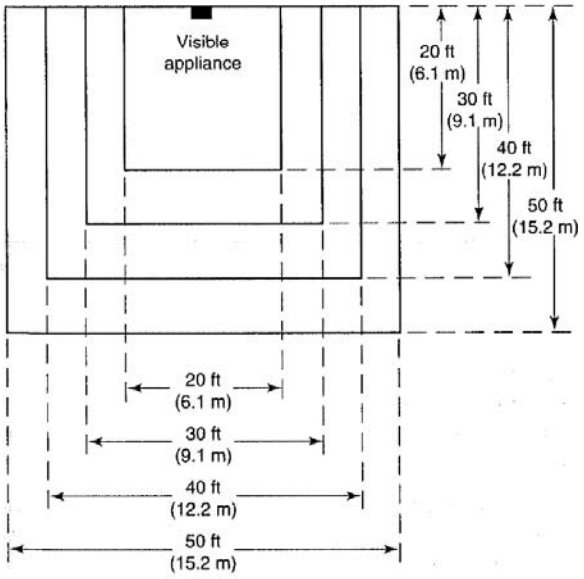
F. Weatherproof strobes shall be Honeywell series or approved equal and shall be UL listed to Standard 1638 for outdoor applications with strobe rated at 75cd (WP75).

G. Each indicating appliance circuit shall be electrically supervised for opens, grounds and short circuit faults, on the circuit wiring, and shall be so arranged that a fault condition on any indicating appliance circuit or group of circuits will not cause an alarm to sound. The occurrence of any fault will light the trouble LED and sound the system trouble sounder, but will not interfere with the proper operation of any circuit which does not have a fault condition.

H. The notification appliance (combination audio/visual units only) shall produce a peak sound output of 90dba or greater as measured in an anechoic chamber. The contractor shall measure sound levels throughout school and adjust speakers so sound levels are 20dBA above average ambient (during school hours) and less than 110dBA. Contractor shall provide measuring report stating locations, ambient sound levels, and speaker temporal sound levels. Measurements shall be take 5’-0” in front of each audible device and 25’-0” in front of each audible device.

I. The notification appliance (combination audio/visual units and visual only units) shall provide field selectable flash intensities of 15cd, 30cd, 75cd, 110cd. The appliance shall be capable of meeting the candela requirements of ADA. Provide, adjust and install audio/visual units and visual units to meet the requirements defined in Room Spacing for Wall-Mounted Visible Appliances Table and Figure below:

Maximum Room Size		*Minimum Required Light Output [Effective Intensity (cd)]*		
ft	*m*	*One Light per Room*	*Two Lights per Room (Located on Opposite Walls)*	*Four Lights per Room (One Light per Wall)*
20 × 20	6.10 × 6.10	15	NA	NA
28 × 28	8.53 × 8.53	30	Unknown	NA
30 × 30	9.14 × 9.14	34	15	NA
40 × 40	12.2 × 12.2	60	30	15
45 × 45	13.7 × 13.7	75	Unknown	19
50 × 50	15.2 × 15.2	94	60	30
54 × 54	16.5 × 16.5	110	Unknown	30
55 × 55	16.8 × 16.8	115	Unknown	28
60 × 60	18.3 × 18.3	135	95	30
63 × 63	19.2 × 19.2	150	Unknown	37
68 × 68	20.7 × 20.7	177	Unknown	43
70 × 70	21.3 × 21.3	184	95	60
80 × 80	24.4 × 24.4	240	135	60
90 × 90	27.4 × 27.4	304	185	95
100 × 100	30.5 × 30.5	375	240	95
110 × 110	33.5 × 33.5	455	240	135
120 × 120	36.6 × 36.6	540	305	135
130 × 130	39.6 × 39.6	635	375	185



J. The appliance shall be polarized to allow for electrical supervision of the system wiring. The unit shall be provided with terminals with barriers for input/output wiring and be able to mount a single gang or double gang box or double workbox with the use of an adapter plate.

K. Power supplies and batteries shall be sized to accommodate 110cd at all strobes.

L. Speaker/Strobe Systems Voice Communication From The FACP (Speaker/Strobe Systems)
1. The fire alarm tone signal, alert tone signal, prerecorded message or live voice announcements shall be capable of being manually transmitted from the FACP to any speaker circuit, selected speaker circuits or all speaker circuits by manual selection of the associated speaker circuit control switches.
2. Manual override, for live voice announcements, via the hand-held microphone and speaker circuit control switches shall take priority over any and all alarm tone signals or prerecorded messages.

2.11 MAGNETIC DOOR HOLDERS

A. Units shall be Honeywell series and listed to UL 228 Units are equipped for surface mounting as indicated and are complete with matching doorplate. Unit shall operate from a 120VAC, 24VAC. 24VDC source and develops a minimum of 25 lbs. holding force.

2.12 REMOTE CRTS AND PRINTERS

A. Fire Alarm Control Unit shall be capable of operating remote CRT's and/or printers; output shall be ASCII from an RS-232-C connection with an adjustable baud rate.

2.13 REMOTE LCD ANNUNCIATOR

A. Provide [1] Remote LCD Annunciator with the same "look and feel' as the FACP operator interface. The Remote LCD Annunciator shall be Honeywell series and use the same Primary Acknowledge, Silence and Reset Keys, Status LEDs and LCD Display as the FACP.

B. Annunciator shall have super-twist LCD display with two lines of 40 characters each. Annunciator shall be provided with four (4) programmable control switches and associated LEDs.

C. Under normal conditions the LCD shall display a "SYSTEM IS NORMAL" message and the current time and date.

D. Should an abnormal condition be detected the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The unit audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

E. The LCD shall display the following information relative to the abnormal condition of a point in the system:
   1. 40 character custom location label.
   2. Type of device (e.g smoke. pull station. water flow)
   3. Point status (e.g. alarm, trouble)

F. Operator keys shall be key switch enabled to prevent unauthorized use. The key shall only be removable in the disabled position. Acknowledge. Silence and Reset operation shall be the same as the FACP.

2.14 GRAPHIC MAP

A. Contractor shall provide and install a weather proof map of the facility. Map shall be on 24” by 36” laminated paper. Contractor shall program descriptions for detection devices to include a location (example: room#, hallway, etc.) and closet column (example: Clmn68). Contractor shall coordinate with District for exact descriptions prior to programming. Map shall be provided with and installed in a weatherproof lockable enclosure, located adjacent to each remote annunciator and fire alarm control panel. District will provide contractor with a drawing of the facility in AutoCAD 2000 format.

PART 3 - EXECUTION

3.01 INSTALLATION

A. No installation shall begin without approved plans from the fire marshal or AHJ.

B. The entire system shall be installed in a workmanlike manner, in accordance with approved manufacturer's wiring diagrams. The Contractor shall furnish all conduit, wiring, outlet boxes, junction boxes, cabinets and similar devices necessary for the complete installation.

C. All penetrations of floor slabs and fire walls shall be fire stopped in accordance with all local fire codes.

D. End of Line Devices (Resistors/Diodes/Capacitors): Shall be furnished as required for mounting as directed by the manufacturer.

E. All wiring shall be color coded throughout, to National Electrical Code standards and a minimum of No. 18 AWG., unless otherwise noted. All wiring shall be of the type recommended by the manufacturer.

F. All wires shall test free from grounds or crosses between conductors.

G. Fire alarm system terminal and junction locations shall be identified in accordance with NFPA Standard 70, Section 760-3. Terminal and junction boxes shall be painted red and stenciled in white letters "FIRE ALARM", preventing unintentional interference with the fire alarm system wiring during testing, servicing and additional modifications to the system.

H. The system shall be arranged to receive power from two/three-wire, 30 Ampere, 120 volt, 60 cycle alternating current supply through fused cut-out with emergency generator backup. All low voltage operation shall be provided from the FACP(s).

I. All final connections between system equipment and the wiring shall be made under the supervision of a trained manufacturer's technical representative.

J. The contractor shall submit to the Authority Having Jurisdiction (AHJ), all necessary drawings and equipment specifications required for a complete AHJ approved system. Drawings shall be prepared by the Contractor.

K. The Contractor shall have a licensed New York State Professional Engineer Stamp all drawings and applications. Pay for all fees to obtain all necessary permits.

L. All junction boxes housing relays must be labeled with P-Touch type labeler with relay point number and device it serves, i.e. (0001-Flow Switch 1).

M. Contractor to review points list prior to programming with Owner. Contractor only to program approved points list. Any changes to program not previously approved by Owner will be done at Contractor’s expense.

3.02 CLEAN UP

A. Upon completion of the installation, all debris created by the installation shall be removed from the premises or disposed of as directed by the Owner.

B. It shall be the responsibility of the installing contractor to assure that construction debris does not adversely affect any sensing devices installed as part of this project. Should it be deemed necessary by the engineer, owner or AHJ, the installing contractor shall be responsible for the clearing of all devices prior to final acceptance.

3.03 TESTS

A. Prior to the final acceptance test, the Contractor and a trained manufacturer's technical representative shall test the completed system for proper operation. The system shall be demonstrated to perform all of the functions as below listed in 3.04 C. Any system, equipment or wiring failures discovered during said test shall be repaired or replaced before requesting scheduling of the final acceptance test.

B. The system shall be tested for final acceptance in the presence of the Owner's representative, Architect's representative, Engineer's representative, the local Code enforcement official, Contractor's representative and the Manufacturer's representative.

C. During the final acceptance test:
   1. Every manual fire alarm station shall be tested.

2. Every smoke detector shall be tested using Honeywell tester or equivalent device.
3. The sprinkler system waterflow alarm switches shall be tested by flowing water. The sprinkler system valve tamper switches shall be tested by closing sprinkler valves. On dry type sprinkler systems, the air pressure shall be measured.
4. Every audible alarm signaling device shall be sounded.
5. Every visual alarm signaling device shall be lit or flashed.
6. Every system control function shall be tested for its proper operation.
7. All supervised circuits shall be opened at two (2) locations to test for proper supervision.

D. Upon successful completion of all final acceptance tests, the Contractor's and Manufacturer's representatives shall each author and sign a letter confirming the successful completion of testing. Two (2) copies of each letter shall be forwarded to the Owner's representative, the Architect's representative, the Engineer's representative and the local Code enforcement official.

E. All final acceptance testing shall be done at a time convenient to the local Code enforcement official and the Owner's representatives and all testing costs shall be born by the Contractor as part of this Contract.

3.04 DOCUMENTATION AND TRAINING

A. The Contractor shall provide the services of a trained manufacturer's employee for a period of four (4) hours, during normal business hours, to instruct the Owner's designated personnel on the operation and maintenance of the entire system. Where multiple shifts are present Contractor to provide a four (4) hour training period for each shift, maximum of 3.

3.05 MAINTENANCE AND TESTING AGREEMENT

A. The equipment manufacturer shall provide to the Owner a price quotation for a one (1) year fire alarm system maintenance and testing agreement to begin upon final acceptance of the system. System Supplier shall have a local service organization with a minimum of 20 factory trained technicians. Technicians shall be NICET Level 2 certified.

3.06 SERVICE AND MAINTENANCE

A. The equipment manufacturer shall make available a fully equipped service organization, capable of guaranteeing an on-site service response time within eight (8) hours to a service request call. Said service shall be available twenty-four (24) hours per day and seven (7) days per week.

B. The equipment manufacturer shall make available, to the Owner, a price quotation for a one (1) year maintenance and testing agreement, to take effect on the date of final acceptance

3.07 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 017500.

B. Provide instruction as required for operating the system. “Hands-on” demonstration of the operation of all system components and the entire system including program changes and functions shall be provided

C. Demonstrate normal and abnormal modes of operation and required responses to each.

D. The Contractor and/or the Systems Manufacturer’s representative shall provide a typewritten “Sequence of Operation” to the Owner at the time of demonstration.

E. Contractor to provide O&M manuals for the fire alarm equipment on disk format.

3.08 MECHANICAL EQUIPMENT SURVEY

A. The contractor shall engage a mechanical testing contractor to perform a mechanical equipment survey of all HVAC equipment which shall include all fans, air handlers, unit ventilators, packaged HVAC units and split system HVAC units. The mechanical testing firm shall provide all testing to determine the CFM rating for each piece of equipment. An equipment with the associated CFM rating, location of equipment and ducted or non-ducted equipment shall be provided to the architect/engineer for review.

3.09 FAN SHUT DOWN

A. The contractor shall provide fan shutdown for all equipment in the mechanical equipment survey rated 1000 CFM or greater. All ducted equipment in the mechanical equipment survey rated 2000 CFM or greater shall have return duct smoke detectors, remote LED indicators and fan shutdown control. All ducted equipment in the mechanical equipment survey rated 15,000 CFM of greater shall have supply and return duct smoke detectors, remote LED indicators and fan shutdown control.

B. All fan reset control shall be independent of fire alarm panel reset control.

C. Provide all control modules; independent reset control modules and duct smoke detectors as required. Provide all required power and control wiring including motor starters.

D. Contractor shall submit control drawings for architect/engineer approval.

3.10 ELEVATOR RECALL

A. The contractor shall provide all new elevator controls as required to provide elevator recall and interface with new fire alarm control panel. Contractor shall engage the services of a qualified elevator contractor to provide controls that upon smoke detection (detector located adjacent to elevator) on the primary floor, the elevator shall go to the alternate floor and remain there until manually reset or if the fire department override key is used. If smoke detection (detectors located on any floor other than the primary floor) the elevator shall go the primary floor and remain there until manually reset or if the fire department override key is used.

B. Provide all new controls, accessories, wiring, conduit and control modules as required.

C. Provide all new controls, to interface elevator control panel, fire alarm controls, wiring and programming panel, shunt trip breakers and operation of sprinkler solenoid valves in shaft.

D. Contractor shall submit control wiring drawings for architect/engineer review.

3.11 GUARANTEE

A. The Contractor shall guarantee all wiring to be free from inherent mechanical and electrical defects for one (1) year. Manufacturer shall make available to the Owner a local service department, which shall stock standard parts on the premises. Maintenance is to be provided during normal working hours, at no cost to the owner, for a period of twelve (12) months from the date of acceptance of the installation, unless damage is caused by misuse, abuse or accident.

END OF SECTION

APPENDIX

FINAL REPORT FOR ENVIRONMENTAL INSPECTION SERVICES –
WHITE PLAINS HIGH SCHOOL (DATED 10/07/2019)

FINAL REPORT OF GEOTECHNICAL INVESTIGATION –
WHITE PLAINS HIGH SCHOOL IMPROVEMENTS (DATED 11/02/2022)