

PROJECT MANUAL

CONCORD CARLISLE HIGH SCHOOL
CONCORD, MA



omrarchitects_{inc}

543 Massachusetts Ave, West Acton, MA 01720
www.omr-architects.com t: 978.264.0160

DESIGN DEVELOPMENT SUBMISSION

Volume 1 of 2

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CONCORD CARLISLE HIGH SCHOOL

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* Trade Bid Required

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* Trade Bid Required

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* Trade Bid Required

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SUMMARY OF WORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents
 - 2. Contract Method
 - 3. Contract Conditions
 - 4. Work under other contracts
 - 5. Work Sequence
 - 6. Owner-furnished products
 - 7. Contractor use of premises
 - 8. Permits, inspection and testing required by Governing Authorities
 - 9. Specification formats and conventions.
 - 10. Reference standards.
 - 11. Miscellaneous Provisions.
 - 12. Proprietary items.

1.3 WORK UNDER THIS CONTRACT

- A. Project Identification:
Concord Carlisle High School
- B. Owner:
Towns of Concord and Carlisle
- C. Owner Project Manager:
KVA Associates, Inc.
- D. Construction Manager:
Turner Construction.
- E. Architect:

Omr Architects, Inc.

F. Description of the Work

1. Project consists of constructing a new regional high school building, abatement/demolition of the existing school building, and associated site work in Concord, Massachusetts.
2. Approximate new school building square footage: 238,000 gsf.
3. Site: Site work includes new parking areas, drives, walks, site utilities, and site improvements.
4. Stretch Code: The Awarding Authority has adopted the Stretch Code for this project. Contractor shall comply with all requirements.
5. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts. Project scores will be verified by a third party certifier.
 - a. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.4 CONTRACT METHOD:

- A. Construction Manager at Risk with prequalified Trade - Contractors as required by Massachusetts Public Bid Laws.

1.5 CONTRACT CONDITIONS

- A. This Contract is subject to applicable State and local laws and all amendments thereto. Where any requirements contained herein do not conform to statutes governing the Work of this Contract, the statutes shall govern.
- B. This Project will be constructed for a political subdivision of the Commonwealth of Massachusetts, and is therefore exempt from State Sales and Use Tax. All bids shall be prepared and purchase of materials for the Project made on the basis of such exemption. After execution of the Contract, the Owner will furnish the Contractor with the exemption number to be used.
- C. The provisions of the Federal Occupational Safety and Health Act (OSHA) apply to the execution of the Work of this Contract, in addition to all other laws, ordinances, rules, regulations, and orders of any Federal, State, or local public authority bearing on the performance of the Work.
- D. Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein, and if, through mistake or otherwise, any such provision is not inserted, or is not correctly inserted, then upon application of either part the Contract shall forthwith be physically amended to make such insertion or correction.

1.6 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

1.7 WORK SEQUENCE

- A. General: The Contractor's attention is directed toward the critical activities and limitations listed in this Article to highlight unusual conditions present in this Project.
 - 1. The Contractor shall be responsible for scheduling the Work accordingly, and in conformance with requirements of all other specifications for the Project.
 - 2. Sequencing requirements shall be clearly identified on all construction schedules required under Section 013200 - Construction Progress Documentation.
 - 3. General Sequence of Work:
 - a. Site clearing and preparation.
 - b. New Construction.
 - c. Existing building abatement and demolition.
 - d. Sitework and Utilities completion.

1.8 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
 - 1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
 - 2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
 - 3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
 - 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 - 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
 - 6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
 - 7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
 - 8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
 - 9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
 - 10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
 - 11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.
- B. Note that items labeled "N.I.C." on the Drawings will be furnished and installed by the Owner under a separate contract after the completion of the Work.
- C. **Owner Furnished Items:**
 - 1. **TBD.**

1.9 CONTRACTOR USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period.
1. Confine operations at the site to areas permitted by laws, by-laws, permits and contract limit lines.
 2. Do not unreasonably encumber the site with materials or equipment.
 3. Coordinate with Owner and Architect work in connection with adjacent occupied buildings or areas, driveways, walks, and other facilities which would prevent access thereto or interrupt, restrict, or otherwise infringe upon use thereof.
- B. **On-Site Work Hours: Work shall be generally performed inside the building during normal business working hours of 7AM – 8PM Weekdays // 8AM – 8PM Saturdays and Sundays / No Work on Holidays. Comply with local noise ordinance. Contractor shall be required to seek work hour variance for requested/planned Work on-site outside of the hours above.**
- C. Existing Utility Interruptions: Refer to Section 011400 - Work Restrictions.
- D. Contractor Parking: Parking of Contractor's vehicles and those of his Subcontractors will be allowed only within Limit of Work area located where shown on Drawings. Contractor shall be responsible for parking arrangements, regulation and control of such parking and resulting traffic. Each Subcontractor shall make arrangements with Contractor for required parking of his vehicles.
- E. On-Site Delivery and Storage of Construction Materials: Do not permit materials and fabricated work to be stacked on, or be transported over, floor and roof construction in such a manner as to stress any construction beyond the designed live loads. Assume full responsibility for protection and safekeeping of products stored on premises. Obtain and pay for use of additional storage or work areas needed for operations. Limit use of site to work and storage of materials for this project.
1. Maintain clean, dry storage areas for construction materials and minimize their exposure to dust. Refer to Section 018119 – Indoor Air Quality Requirements and individual Division 2 through 50 Sections for additional requirements.
 2. Do not store foamed polystyrene, polyurethane or like materials within the building. Take proper precautionary measures regarding the Storage of such materials outside the building.
- F. Contractor shall be responsible for adequate site drainage during the entire construction period and shall use any appropriate temporary means that does not adversely affect construction progress or abutting property.
- G. Contractor shall take all necessary safety precautions and maintain an adequate level of fire protection at all times.
1. Refer to Section 011400 – WORK RESTRICTIONS and 015000 – TEMPORARY FACILITIES AND CONTROLS for additional requirements.
- H. Do not use areas outside the Limit of Work area for temporary storage or structures without specific written permission from the Architect and Owner.

1.10 PERMITS, INSPECTION AND TESTING REQUIRED BY GOVERNING AUTHORITIES

- A. If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested, or approved, the General Contractor shall give the Architect and such Authority timely notice of its readiness so the Architect may observe such inspection and testing.
- B. Prior to the commencement of construction, the General Contractor shall complete application to the appropriate Building Code enforcement authority for a Building Permit. Such Permit shall be displayed in a conspicuous location at the Project Site.
- C. **Payment requirements for this permit fee are waived by the Owner. Waiver of permit fee in this instance shall not be understood to apply to other permit and fee requirements for the Project.**

1.11 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect as of the bid date, except when a specific date is specified.
- C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

1.12 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
 - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
 - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - 2. All instructions in the Specifications are addressed to the Contractor unless the responsibility of the Architect or Owner is clearly indicated.
 - a. Where products are listed or described in outline form, the phrase "The Contractor

shall furnish these products" is implied.

- b. Where installation instructions or performance criteria are listed or described in outline form, the phrase "The Contractor shall perform the Work in accordance with these requirements" is implied.
- c. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

C. Definitions:

1. Indicated: The word "indicated" refers to graphic representations, notes or schedules on Drawings, Paragraphs or schedules in Specifications, and similar requirements in Contract Documents. Terms such as "shown", "noted", "scheduled", and "specified" are used to help locate a reference. No limitation on location is intended except as specifically noted.
2. Directed: Terms such as "directed", "requested", "authorized", "selected", "approved", "required", and "permitted", are hereby defined as "directed by Architect", "requested by Architect", "authorized by Architect". No implied meaning shall be interpreted to extend the Architect's responsibility into the Contractor's area of construction supervision.
3. Approve: The term "approved" when used in conjunction with the Architect's action on the Contractor's submittals, applications, and similar requests, is limited to the duties and responsibilities of the Architect as stated in GENERAL CONDITIONS. Such approval shall not release the Contractor from responsibility to fulfill Contract requirements unless otherwise provided in the Contract Documents.
4. Furnish: Supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
5. Install: Operations at Project Site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
6. Provide: To furnish and install, complete and ready for intended use.
7. Installer: The Contractor or entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
8. Owner: The Awarding Authority.
9. Authority having Jurisdiction: Any State, Local, or legal authority, as defined by statute.

D. "Or Equal", "Or Equivalent": clause:

1. Where products or materials are prescribed by manufacture name, trade name or catalogue reference, the word "or approved equal" shall be understood to follow.
2. An item shall be considered equal or equivalent to the named item, if all of the following conditions are met:
 - a. It is at least equal in appearance, quality, durability, strength and design.
 - b. It meets or exceeds all performance requirements specified.
 - c. It performs the function of the item to an equal or superior standard as does the named item.
3. All deviations from products specified shall be submitted as substitutions. For related procedures, refer to Section 013300 – Submittal Procedures.

1.13 MISCELLANEOUS PROVISIONS

- A. Discovery: If during the excavation or other work, articles of unusual value, or of historical or archaeological significance are encountered the ownership of such articles is retained by the Owner, and information regarding their discovery shall be immediately furnished to the Architect.

1. If the nature of the article is such that the work cannot proceed without danger of damaging same, work in that area shall be immediately discontinued until the Architect has decided the proper procedure to be followed.
 2. Any time lost thereby shall be a condition for which the time of the Contract may be extended.
 3. All costs incurred after discovery in the salvaging of such articles shall be borne by the Owner.
- B. Refer to Section 013100 – Project Management and Coordination, Article 1.4, B. for particular project supervision requirements.

1.14 PROPRIETARY ITEMS

- A. The following items have been approved to be proprietary by the Awarding Authority for use on this project. It has been determined that it is in the public interest that the materials listed herein be incorporated into the work without substitution:
1. **TBD.**
- B. Refer to individual specification sections for additional information and requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011400
WORK RESTRICTIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Contractor responsibility for Architect's additional services.
 - 2. Construction Documents, Project Electronic Files and graphic reproduction of Contract Documents.
 - 3. Interpretation and modification of Contract Documents.
 - 4. Contractor's reports.
 - 5. Cleaning materials
 - 6. Safety and disposal requirements.
 - 7. Conduct of the Work.
 - 8. Existing Utilities.
 - 9. Conduct of construction personnel and noise control.
 - 10. Safety and disposal requirements and accident prevention.
 - 11. Welding and cutting.
 - 12. Fire watch.
 - 13. Municipal police services
 - 14. Storage of materials off-site
 - 15. Dust control.
 - 16. Cleaning during construction.
 - 17. Debris control and removal of rubbish.
 - 18. Pollution control.
 - 19. Owner's occupancy requirements
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION: Preparation and execution of construction schedule.
 - 2. Section 013100 – PROJECT MANAGEMENT COORDINATION: Procedures and responsibilities for coordinating the Work.
 - 3. Section 013300 – SUBMITTAL PROCEDURES. Submittal procedures.

4. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional information on temporary measures required during construction.
5. Section 017400 – CLEANING AND WASTE MANAGEMENT, for removal of non-hazardous debris including provisions for recycling and disposal.
6. Section 017700 – CLOSEOUT PROCEDURES: Procedures for completing the Work.
7. Section 017839– PROJECT RECORD DOCUMENTS: Preparation of record drawings and other documents.
8. DIVISION 31 – EARTHWORK, for removal of contaminated soils and liquids.

1.3 SUBMITTALS

- A. General: Refer to Section 013300– SUBMITTALS, for submittal provisions and procedures.
- B. Layout of Temporary Construction Facilities: Submit location plan showing office, trailer and storage layout.
- C. Logistics Plan:
 1. Contractor shall submit to the Architect, at the Pre-construction Meeting, a detailed Logistics Plan, which shall include:
 - a. Delivery Hours and Delivery Routes
 - b. Gate location, and wheel washing location.
 - c. Hours of Work
 - d. Trailer Area, and Layout of trailers
 - e. Parking locations for use of Owner and Contractor within the area of work
 - f. Temp fencing, erosion control, and metering locations
 - g. Location for stockpiling of soil
 - h. Location for stockpiling plowed snow
 - i. Locations for waste management containers.
 - j. Protection of existing curbs and walkways.
 - k. Lighting Plan
 - l. Traffic plan.
 - m. Police detail.
 - n. Pedestrian safety plan on site.
 2. Refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for specifications for temporary construction and other items to be shown on Logistics Plan.
 3. No work shall commence until the Logistics Plan has been approved.
 4. The General Contractor shall meet with the Police Department prior to work in order to get a truck route approved for the project.
- D. Photographs: Progress Prints and videotapes as specified in this Section.
- E. Reports:
 1. Documentation of off-site storage facilities.
 2. With each Application for Payment, submit the following reports, compiled on a monthly basis:
 - a. Contractor's Reports
 - b. Proof of submission of Certified weekly payrolls to Owner.

1.4 CONTRACTOR RESPONSIBILITY TO THE OWNER FOR ARCHITECT'S ADDITIONAL SERVICES

- A. The Contract between the Owner and the Architect contains provisions for additional services that may be required of the Architect during construction due to unforeseen conditions.
 - 1. Where such additional services become necessary due to the activities of the Contractor, as determined by the Owner's Project Manager, costs for such services will be the responsibility of the Contractor, and will be deducted from the Contract Amount.
- B. Additional services for which the Contractor is responsible for cost to the Owner may include the following activities of the Architect:
 - 1. Review of Requests for Information and Change Order Requests for work determined to be covered in the Contract Documents. Refer to related Articles in this Section.
 - 2. Continuation of construction administration beyond the dates specified for Final Completion of the Work: Refer to Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 - 3. Review of re-submitted submittals and Substitution Requests that have been rejected: Refer to Section 013300 – SUBMITTAL PROCEDURES.
 - 4. Re-inspection of incomplete work: Refer to Section 017700 – CLOSEOUT PROCEDURES.
 - 5. Design services for the resolution of non-conforming work.

1.5 CONSTRUCTION DOCUMENTS

- A. The General Contractor shall retain copies of the Contract Documents issued to them for bidding purposes.
 - 1. The Owner will furnish to the General Contractor, without additional charge, an additional ten (10) complete sets of the Contract Documents, including Drawings and Specifications, for use during the construction period.
 - 2. Extra sets returned by bidders and not required for other purposes, as determined by the Owner's Project Manager, will be made available to Contractor and Subcontractors for the Work.
- B. All other hard copies of the Contract Documents required by the Contractor or subcontractors for use during the construction period shall be purchased by the party requiring same. Owner's Project Manager will furnish approximate costs of such additional copies and will transmit originals to local printing companies with whom he regularly does business, but will not receive bills for such printing through his account. All negotiations for such printing shall be between Contractor and Printer.
 - 1. Refer to provisions in this Section, for electronic copies of documents to be made available for the Contractor's use during construction.
 - 2. Refer to Section 017839 – PROJECT RECORD DOCUMENTS, for additional sets to be provided by the Owner to the Contractor for the purpose of maintaining record prints of the Work as construction proceeds.

1.6 PROJECT ELECTRONIC FILES

- A. Definitions:

1. Contract Documents: Printed hard copies of drawings and other documents, as defined in the General Conditions and listed in the signed copy of the Form of Agreement between Owner and Contractor.
 - a. In case of conflict between the Contract Documents and documents obtained through electronic means, the Contract Documents shall govern.
 2. Project Electronic Files: Electronic copies of electronic documents for the Project, comprising drawings listed on Document 011401 – Electronic Release Form.
- B. General Procedures: At the Pre-Construction Meeting, the Architect will present to the Contractor one compact disc (CD) with Project Electronic Files, for use in the preparation of coordination and record documents for the Project.
1. Release Forms Required:
 - a. The Contractor shall sign a copy of Document 011401 – Electronic Release Form, to be filled out and issued by the Architect.
 - b. By signing the release form, the Contractor is acting on behalf of all their subcontractors for the Work of this Project.
 2. Additional copies of the compact disc with Project Electronic Files will be available from the Architect at an additional cost.
- C. Electronic File Format:
1. Editable Files: Electronic files for drawings listed on Document 011401 – Electronic Release Form will be furnished in “*.DWG” format.
 2. Printable, Non-Editable Files: Electronic files for all Drawings in the Bid Set and for Drawings issued as Addenda will be furnished in “*.PDF” format (Adobe Acrobat Reader, version 6.0).
 3. The Architect does not warrant that these electronic documents are compatible with any software or hardware other than those on which they were produced.
- D. Permitted Use of Project Electronic Files: Use of electronic files by the Contractor and Sub-Contractors is limited to the following activities:
1. Project Electronic Files may be used as a guide only for the preparation of Coordination Drawings and Record Drawings to be submitted as a requirement for the Project.
 2. Project Electronic Files may be used as a guide only for preparation of shop drawings. Exact copies of Contract Documents will not be accepted if submitted for these purposes, unless specifically permitted by an individual specification Section.
- E. Responsibilities of Contractor: Use and reproduction of Project Electronic Documents are subject to the following conditions:
1. The use of Project Electronic Files, reproduced either electronically or by other graphic reproduction methods, does not in any way alter the responsibilities of the Contractor for final system coordination. The Contractor shall incur all liability in this respect.
 2. The Contractor and all Subcontractors are responsible for checking the dimensions and completeness of the Project Electronic Files, and for determining any possible errors and omissions, as required by the General Conditions.
 3. The Contractor is responsible for updating Project Electronic Files as necessary to incorporate changes to the Work shown in Addenda and documents issued during construction.
 4. In no event shall the Architect or any other Person or Firm involved in the creation, pro-

duction or distribution of the reproducible or electronic documents, be liable to the persons utilizing the documents, on account of any claim for damages. Each Person or Firm utilizing these documents agrees to release, indemnify, hold harmless and defend the Architect, its officers, employees and consultants from an against all liability arising out of such firm's use of the electronic or reproduced documents or information referred to herein.

- F. Ownership of Documents: By transferring copies of Project Electronic Files, the Architect. and the Owner do not in any way convey the copyright in the designs contained therein, nor do they convey a license to copy or use them for any purpose except as required for the construction of the Project.
- G. License for Software: By transferring copies of Project Electronic Files, the Architect does not in any way convey transfer license to use the software on which the documents were prepared. Each entity using Project Electronic Files is responsible for obtaining licenses as needed for its use of those files.

1.7 GRAPHIC REPRODUCTION OF CONTRACT DOCUMENTS

- A. Reproduction of Contract Documents issued for the Project, by graphic reproduction methods, shall be subject to the conditions outlined for reproduction of Project Electronic Files.

1.8 INTERPRETATION AND MODIFICATION OF CONSTRUCTION DOCUMENTS

- A. Refer to General and Supplementary Conditions for general information on Change Orders, Work Change Directives, Field Orders and Architect's written amendments and clarifications. The intent of this Article is to provide for additional procedures to be followed during construction.
- B. Requests for Information: Each time the Contractor or Subcontractor has a reasonable question on the interpretation of the Contract Documents, they shall submit in writing a Request for Information (RFI) to the Architect for response.
 - 1. The Contractor shall examine field conditions carefully and review the Drawings and Specifications thoroughly prior to issuing an RFI.
 - 2. The Contractor shall keep a log of RFI's, numbering them in the order in which they are issued.
 - 3. Each RFI shall contain a clear statement of the question, references to relevant Contract Documents and additional background information as needed to facilitate the Architect's review.
 - 4. All requests for information from Subcontractors shall be made through the Contractor and addressed to the Architect, and the Architect will distribute them as needed to the appropriate Consultants. A copy of each RFI shall be given to the Clerk of the Works.
 - 5. RFI's shall be issued in a timely manner to permit a thorough review and preparation of a response by the Architect and their Consultants. The Contractor shall identify on the RFI form whether the RFI is low, medium or highly critical and shall note the date that the RFI response is due in order not to affect the construction progress schedule.
 - 6. The Architect will prepare a written response to each RFI within 10 workdays, or sooner if the Contractor provides a realistic date when the response will be needed.
- C. Proposal Requests: During construction, it may become necessary or desirable to modify the Contract Drawings or Specifications in response to concealed existing conditions, changes in

the Owner's program or other unforeseen circumstances.

1. Where such a modification may involve a change in the Contract price or time, the Architect will prepare a Proposal Request describing the modification under consideration, including sketches or drawings, specifications and other information to permit pricing by the Contractor.
2. Copies of each Proposal Request and its attachments will be distributed to the Owner, Clerk of the Works and Contractor.
3. The Contractor shall respond in a timely manner with a Proposed Change Order detailing the estimated costs and change in Contract duration, for review by the Architect and approval by the Owner.
4. A Proposal Request will not constitute direction to proceed with the modification unless accompanied by a Work Change Directive and an estimated price.

D. Change Order Requests: If the Contractor is required to perform Work that they consider to represent a change in the cost of the Project, they may submit Change Order Requests for such work in accordance with the General Conditions and Supplementary General Conditions.

1. Each Change Order Request shall be accompanied by a document describing the modification under consideration, including sketches or drawings, specifications and other information to permit review of pricing by the Architect and Owner.
2. Distribute copies of each Change Order Request and its attachments to the Owner, Clerk of the Works and Architect.
3. The Architect and Owner will respond in a timely manner with a Proposed Change Order incorporating the Change Order Request if it is approved.
4. Verbal approval of a Change Order Request will not constitute direction to proceed with the modification unless accompanied by a Change Order, or a Construction Change Directive with an estimated price.

E. Architect Review of Contractor-Generated Requests for Information and Change Order Requests: The Architect will review and prepare written responses to the Contractor's Requests for Information and Change Order Requests that are submitted in accordance with the requirements of this section.

1. If the Contractor submits an excessive number of requests for information that are incomplete, or for which the information requested is available from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared or other prior Project correspondence or documentation, then the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to review those requests for information.
2. If the Architect determines that the Work covered by a Change Order Request is covered by the scope of the Contract Documents, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to evaluate proposals and prepare Instruments of Service associated with such Change Order Request.
3. Refer to other paragraphs in this Section for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.

1.9 CONTRACTOR'S REPORTS

A. A daily report summarizing the work performed, weather conditions, number of workers, amount and kinds of equipment, unusual occurrences, and the like shall be submitted by the Contractor's Field Superintendent to the Architect, the Owner, the Clerk of the Works, each

working day covering the work performed on the previous working day.

- B. Form of the daily report shall be as approved by the Architect.
- C. Attention is directed to recent amendments to MGL Chapter 149, Section 27B requiring submission of certified weekly payrolls directly to the Awarding Authority by every contractor and subcontractor doing public work.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Use only those materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer or surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 CONDUCT OF WORK

- A. The Contract Site shall be as shown on the Drawings, and shall include the entire area bound by the "Contract Limit" or "Limit of Work" lines as well as all areas outside of the Limit of Work Lines when required for performance of work under this Contract.
- B. Contractor shall take all steps necessary to protect existing conditions to remain. Damage to existing work caused by Contractor's operations under this Contract shall be repaired at Contractor's expense.
- C. Any street, paving, curb and/or sidewalk damaged as the result of work under this Contract, whether within or outside the limits of the Work, shall be repaired and/or replaced with new matching construction by the Contractor at his expense and in a manner satisfactory to the Architect and authorities having jurisdiction.
- D. Protection of Curbs and Walkways: Where existing curbs or walks are to remain, or after new curbs or walks are constructed and trucking is required over them, they shall be suitably protected as shown on approved Logistics Plan.
- E. Trenching and other work outside construction limits shall be expedited to the fullest and carried out with minimum of inconvenience to normal operations of Owner and public traffic. Walks, paved or landscaped areas over which temporary driveways cross shall, upon completion of the Work, be restored to their original condition with new construction. Temporary roadways shall be bridged over trenched areas.
- F. Provide continuous, lawful, safe, adequate and convenient access to the site. Contractor shall construct and maintain in good, safe, usable condition temporary roads, capable of supporting emergency vehicles, and appurtenances as required, and when no longer required,

remove temporary construction and restore such areas to their original condition, or as otherwise specified in the Contract Documents.

3.2 EXISTING UTILITIES

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- B. Immediately repair any active existing utility lines (cables, conduit, ducts, and piping), damaged during the course of construction. Protect and maintain such active existing utilities in use, until relocation of same has been completed or utilities have been cut, capped, or prepared for new service connections, as applicable. Perform such repair and protection work at no additional cost to the Owner.
- C. If any existing active utility not indicated on the Drawings is unintentionally damaged, and such utility is to remain, immediately repair the damage and restore the utility to its original integrity. Reimbursement of cost for performing such repair will be made by an adjustment in the Contract Price in accordance with the General Conditions of the Contract.
- D. Any adjustment as outlined above shall be based on the assumption that the Contractor has performed in a prudent manner at the time such damage occurred. If extra expense is incurred in protecting and maintaining any utility line not shown on the Drawings, nor revealed by a "Dig-Safe" inspection, an adjustment in the Contract Price shall be made.
- E. The Owner will cooperate and assist the Contractor in locating and identifying underground utilities. Contractor shall cooperate and participate in "Dig Safe" programs, notifying proper authorities before proceeding.
- F. If it becomes necessary to interrupt power, water line, sewer, gas or other utilities to adjacent buildings, notify the Architect and Owner's Project Manager at least four (4) days in advance. Schedule such interruptions at such times as will minimize disruption and inconvenience to users.

3.3 CONDUCT OF CONSTRUCTION PERSONNEL

- A. Under the provisions of the Education Reform Act of 1993, smoking is not permitted on school property, including the construction site.
- B. Use of profanity is prohibited.
- C. CORI Requirements: When the project site is occupied by the Owner, all personnel on site shall be CORI checked. Comply with local ordinances and Owner CORI requirements.

3.4 NOISE CONTROL

- A. Develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum. Submit noise abatement program to Owner's Project

Manager and Architect for review prior to use of noise generating equipment.

- B. Execute construction work by methods and by use of equipment that will reduce noise and which will provide minimum interference with neighborhood activities.
 - 1. Employ construction methods and equipment that will produce the minimum amount of noise.
 - 2. Equip air compressors with silencers, and power equipment with mufflers.
 - 3. Handle vehicular traffic and scheduling to reduce noise.
- C. Do not allow radio and electronic entertainment equipment to be operated at volume that makes ordinary conversation difficult at ten (10) feet from such equipment.
- D. Do not run equipment, including idling of vehicles outside of the specified hours of work.

3.5 SAFETY AND DISPOSAL REQUIREMENTS

- A. Standards: Maintain project in accordance with State Building Code and local ordinances.
- B. Hazards Control: Store volatile wastes in covered metal containers and remove from premises. Prevent accumulation of wastes which create hazardous conditions. Provide adequate ventilation during use of volatile and noxious substances.
- C. Disposal: Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws. Do not burn or bury rubbish and waste materials on project site. Do not dispose of hazardous wastes such as solvents, mineral spirits, oil, paint, paint thinner in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

3.6 ACCIDENT PREVENTION

- A. Comply with all Federal, State and municipal recommendations and requirements for safety and accident prevention, those of the Associated General Contractors of America and the American National Standards Institute (ANSI Standard A10.2). Conduct regular, frequent inspections of the site for compliance with safety regulations.
- B. Neither the Owner nor the Architect will be responsible for providing a safe working place for the Contractor, Subcontractors, or their employees, or any individual responsible to them for the Work.

3.7 WELDING AND CUTTING

- A. Where electric or gas welding or cutting work is done above or within ten (10) feet of combustible material or above space that may be occupied by persons, use interposed shields of incombustible material to protect against fire damage or injury due to sparks and/or hot metal.
- B. Place tanks supplying gases for gas welding or cutting at no greater distance from the work than is necessary for safety, securely fastened and maintained in an upright position where practicable. Such tanks, when stored for use, shall be remote from any combustible material and free from exposure to the direct rays of the sun or high temperatures. Storage shall be secured under lock and key, to prevent unauthorized use of gas and equipment.

- C. Maintain suitable fire extinguishing equipment near all welding and cutting operations. When operations cease for the noon hour or at the end of the day, thoroughly wet down the surroundings adjacent to welding and cutting operations. Properly protect any new materials, stored or installed, that are subject to water damage.
- D. Station a worker equipped with suitable fire extinguishing equipment near welding and cutting operations to see that sparks do not lodge in floor cracks or pass through floor to wall openings or lodge in any combustible material. Keep the worker at the source of work which offers special hazards for a minimum of thirty (30) minutes after the job is completed to make sure that smoldering fires have not been started.
- E. Place a qualified electrician in charge of installing and repairing electric and arc welding equipment.

3.8 FIRE WATCH

- A. Comply with authorities having jurisdiction for fire watch requirements during hot work operations. Hot work shall include but not be limited to welding, torch and open flame work, cutting of steel, and other similar operations. Schedule and pay for fire watch services as required by authorities having jurisdiction.
 - 1. The contractor shall visit the fire department to get a permit for any type of temporary heaters. Fire watch will be required for any welding after the structure is closed in.

3.9 MUNICIPAL POLICE SERVICES

- A. Make all necessary arrangements with the municipal police department in advance of times when regular, off-duty, or reserve police officers will be needed for traffic control or protection due to operations performed under this Contract.
- B. Pay police officers in accordance with rates established by the municipality for such services:
- C. Extend the Worker's Compensation Insurance and Employer's Liability Insurance required under the General Contract to cover police used on the Project.

3.10 STORAGE OF MATERIALS OFF SITE

- A. The Contractor, Subcontractors and Sub-subcontractors shall obtain prior written approval from the Owner through the Architect for permission to store materials to be incorporated in the Work, for which Progress Payments will be requested, at off-site locations. Any and all charges for storage, including insurance, shall be borne solely by the Contractor. Before approval, Owner will require proper proof of insurance and a letter in which is furnished:
 - 1. The names of the Contractor and/or Subcontractor or subordinate Subcontractor leasing the storage area.
 - 2. The location of such leased space.
 - 3. Description of the leased area: The entire premises or certain areas of a warehouse giving the number of floors or portions thereof.
 - 4. The date on which the material is first stored.
 - 5. The value of the material stored.
 - 6. Transfer of title for such materials in a form acceptable to the Owner.

- B. Requirements for storage facility at which materials will be stored off-site:
 - 1. The storage facility shall be a bonded warehouse.
 - 2. The Contractor shall permit access to the storage facility to the Clerk of the Works upon request.
- C. Contractor, Subcontractors and subordinate Subcontractors shall provide prior to the request for payment for such stored materials, adequate advanced notice, to the Architect so that the Owner or Architect can inspect, at their convenience, the materials being stored at any location.
- D. Each sealed carton shall be marked with the Project name, the Owner's name and the Architect's name as they appear in the Agreement.
- E. A perpetual inventory shall be maintained for all materials held in storage for which payment has been requested.
- F. Payment for materials stored off site shall be at the sole discretion of the Owner. Any additional costs to the Owner resulting from storage of material off site for which payment is requested, such as, but not limited to, travel expenses and time for inspectors shall be back-charged to, and paid by, the Contractor.

3.11 DUST CONTROL

- A. Maintain the construction site, stockpiles, access, detour, and haul roads, staging and parking area used for the Work, free of dust which would cause a hazard or a nuisance to those at the site or adjacent sites.
- B. Provide environmentally safe and positive methods and dust control materials to minimize raising dust from construction operations, and provide positive means to prevent air-borne dust from dispersing into the atmosphere.
- C. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
- D. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- E. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces, including paint, coatings, sealants, caulking, adhesives.
- F. Furnish, erect, and maintain for the duration of the work period, temporary fire-retardant dust proof coverings and partitions as required to prevent the spread of dust beyond the immediate area where work is being performed.
- G. These provisions do not supersede any specific requirements for methods of construction or applicable regulations or general conditions set forth elsewhere in the Contract with regard to performance obligations of the Contractor.

3.12 CLEANING DURING CONSTRUCTION

- A. Execute cleaning during progress of work and at Substantial Completion, as required by

General Conditions, in accordance with MCHPS requirements, and as herein specified. Refer to Section 017400 – Cleaning and Waste Management for more information.

- B. Maintain premises and public properties free from accumulations of waste, debris and rubbish caused by operations. At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all exposed surfaces; leave project clean and ready for occupancy.
- C. Cleaning shall be in addition to cleaning specified under other sections and shall include all surfaces, interior and exterior in which or to which the Contractor has had access.
- D. Refer to Sections of the Specifications for cleaning of specific products.
- E. Execute cleaning to ensure that the building, the site, and adjacent properties are maintained free from accumulations of waste materials and rubbish and windblown debris, resulting from construction operations.
- F. Provide on-site containers for collection of waste materials, debris and rubbish.
- G. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal areas off site.
- H. Handle materials in a controlled manner with as few handling as possible. Do not drop or throw materials from heights.
- I. Schedule cleaning operations so that dust and other contaminants resulting from cleaning processes will not fall on wet newly painted surfaces, uncured caulking, sealants, adhesives, and other material.

3.13 DEBRIS CONTROL AND REMOVAL OF RUBBISH

- A. Ensure that each Subcontractor engaged in the Work bears full responsibility for cleaning up during on a daily bases and immediately upon completion of his work, and removes all rubbish, waste, tools, equipment, and appurtenances caused by and used in the execution of his work; but this shall in no way be construed to relieve the General Contractor of primary responsibility for maintaining a clean building and site free of debris, leaving all work broom clean and in a condition satisfactory to the Architect, Project Manager, and Owner. Refer to Section 017400 – Cleaning and Waste Management for more information.
- B. Provide at least one tightly built chute serving each level which shall lead down to angle offset and sliding panel chute at a convenient loading point for trucks or dumpsters.
- C. Do not permit any material to be thrown from open floors, windows or roof of the building.
- D. Immediately after unpacking, remove all packing materials, case lumber, excelsior, wrapping and other rubbish, flammable and otherwise, from the building and premises.
- E. Initiate and maintain a specific program to prevent the accumulation of debris at the construction site, storage and parking areas, or along access roads and haul routes: Provide containers for deposit of debris and schedule periodic collection and disposal of debris. Prohibit overloading of trucks to prevent spillage on access and haul routes.
- F. Contractor shall make provisions for snow and ice removal, as required. In addition Contract-

tor shall provide wheel-washing stations at site egress gates, as directed by the Project Manager, to maintain clean neighborhood streets.

3.14 POLLUTION CONTROL, GENERAL

- A. Provide methods, means and facilities required to prevent contamination of soil, water and atmosphere by the discharge of noxious substances from construction operations.
- B. Remediation of Spills: Provide equipment and personnel, perform emergency measures required to contain any spillages, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off site and replace with suitable uncontaminated compacted fill and topsoil, in accordance with the requirements of Section 310000 - EARTHWORK.
- C. Take special measures to prevent harmful substances from entering public waters. Prevent disposal of wastes, effluents, chemicals, or other such substances adjacent to streams or in sanitary or storm sewers.
- D. Provide systems for control of atmospheric pollutants. Prevent toxic concentrations of chemicals. Prevent harmful dispersal of pollutants into the atmosphere.

3.15 OWNER'S OCCUPANCY REQUIREMENTS

- A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion dates, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.
- B. If the Project is substantially complete by the specified date for Substantial Completion, the Owner at his election may from time to time, or permanently, occupy the building or any portion thereof as the work is completed to such a degree as will, in the opinion of the Owner, permit the use of the building or other portions of the Project for the purpose for which they are intended.
- C. The Owner will, prior to any such partial occupancy, give notice to the Contractor thereof and such occupancy shall be predicated upon the following conditions:
 - 1. In the case of partial occupancy prior to the stipulated completion date, the Owner shall secure endorsement from the Contractor's insurance carrier and consent of the surety permitting occupancy of the building or use of the Project during the remaining period of construction.

2. In the case of partial occupancy after the stipulated completion date, the Contractor shall extend all the necessary insurance coverage as stipulated until the date of Final Acceptance of the Project. Owner's use and occupancy prior to final Acceptance shall not relieve the Contractor of his responsibility to maintain the insurance coverage as required by the Contract Documents.
3. In case of such partial occupancy, the guarantee period called for by the Contract Documents shall commence on the date of Substantial Completion of the Phase containing the guaranteed Work.
4. Occupancy of the building or any portion thereof by the Owner, shall not constitute an acceptance of the Work or of work not performed in accordance with the Contract Documents or relieve the Contractor of responsibility to perform any work required by the Contract but not completed at the time of occupancy.
5. If the Owner occupies the building as a result of the Contractor's failure to substantially complete the work by the specified date, the Contractor shall pay maintenance costs on the portion of the building occupied under this Agreement until Substantial Completion.
6. The Contractor shall be required to furnish heat, electricity and water used in the occupied portion of the building, from the time of the occupancy by the Owner until Substantial Completion of the new high school.

END OF SECTION

Attachments:

Document 011401 – Electronic Release Form

FORM 011401
ELECTRONIC RELEASE FORM

To: [Construction Manager]
[Street]
[Town, State]

Date: [Date documents are transmitted]

Project: Concord Carlisle High School

RE: Project Electronic Files

Project Electronic Files are made available to the undersigned with the following conditions:

The undersigned agrees to accept from OMR Architects, Inc. the electronic files for the referenced project, as listed in the attached table, without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, accuracy and/or completeness of any information contained therein.

The undersigned further agrees that such information shall be used as reference material only and then only for the referenced project and not for any other projects or future additions to the referenced project, without express written consent from OMR Architects, Inc. for each instance.

The undersigned further agrees to release, indemnify, hold harmless and defend OMR Architects, Inc. with respect to any claims, costs, losses, damages and/or liabilities arising out of, or relating to the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of any such information.

The undersigned further agrees to the requirements and limitations for the use of Project Electronic Files as stated in Section 011400 - Work Restrictions.

Sincerely,
OMR Architects, Inc.

Accepted and Agreed to:

(Construction Manager)

By: _____

Title: _____

Attachment: List of Project Electronic Files

List of Project Electronic Files

File Format	Drawing number	Drawing title
PDF	All drawings listed on Drawing List-Volume 1 & 2	Entire Bid Set of Drawings
PDF	Addenda	All Addenda issued

Additional Electronic Files for Use during Construction:

File designation	Document number	Document title
013310.PDF	Document 013310	Substitution Request Form

END OF FORM

SECTION 012200
UNIT PRICES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for unit prices and estimated quantities.
- B. Related Sections include the following:
 - 1. Document 002113 – INSTRUCTIONS TO BIDDERS, for additional instructions regarding unit prices and estimated quantities and bids.
 - 2. Document 004100 – FORM FOR GENERAL BID, for additional instructions regarding unit prices and estimated quantities and bids.
 - 3. Appendix 012201 – UNIT PRICE PROPOSAL SHEET, for unit prices and estimated quantities.
 - 4. DIVISION 02 through DIVISION 33 for procedures, materials, and execution requirements related to unit price work.

1.3 DEFINITIONS

- A. Unit Price: A unit price is an amount proposed by Bidders on the Bid Form as a price per unit of measurement for materials or services added to the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased. If the estimated quantities of Work required are decreased, the value of the Unit Price will be reduced as described on the Unit Price Proposal Sheet.

1.4 PROCEDURES

- A. Each unit price includes all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: Refer to individual Specification Sections and Appendix 012201 – UNIT PRICE PROPOSAL SHEET for work that requires establishment of unit prices and estimated quantities. Methods of measurement and payment for unit prices and estimated quantities are as follows:
 - 1. For work covered by scheduled quantities, notify the Owner and Architect a minimum of 24 hours in advance of the performance of such work.
 - 2. Document such work in writing, identifying type of work, quantity and location of work. Submit documentation on Contractor's letterhead.
 - 3. All documentation of work covered by scheduled quantities will be subject to verification and approval by the Owner and Architect.
 - 4. In order to be considered for payment, documentation for work covered by scheduled

quantities shall be submitted within one month of performance of such work. Requests for payment of such work submitted more than one month after the work has been performed will not be accepted.

5. Only Documentation signed and verified by the Contractor, Trade, and the Owner's Representative will be considered valid. Documentation not signed by all these parties will be considered invalid.

- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and estimated quantities and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

- D. Schedule of Unit Prices and Estimated Quantities:
 1. Specification Sections referenced in the Unit Price Proposal Sheet contain requirements for materials described under each unit price.
 2. A Schedule of unit prices and estimated quantities to be proposed by Bidders follows this section.

- E. Refer to Document 002113 – INSTRUCTIONS TO BIDDERS, and Document 004100 – FORM FOR GENERAL BID, for additional information regarding unit prices and estimated quantities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES AND ESTIMATED QUANTITIES

- A. See Appendix 012201 – UNIT PRICE PROPOSAL SHEET following this section.

END OF SECTION

APPENDIX 012201
UNIT PRICE PROPOSAL SHEET

CONCORD CARLISLE HIGH SCHOOL
CONCORD, MA

1. The following unit prices as defined in the specifications are designated for items of work on the basis of unknown quantities or quantities estimated by the Designer. These unit prices will be used to add or to deduct from the dollar amounts shown, depending on whether the actual amount is greater or less than the estimated amount. UNIT PRICES GIVEN HEREIN SHALL BE FOR ADDITIONAL WORK ONLY. DECREASED WORK SHALL BE AT THE "ADD" PRICE LESS FIFTEEN PERCENT (15%).

Unit Price Number	Specification section and Description	Estimated Quantity	Unit Measure	Unit Price Dollars/Cents	Total Amount for estimated quantity - Dollars/Cents
1	310000 – Earthwork: Open General Excavation.	N/A	Cubic Yard		N/A
2	310000 – Earthwork: Trench General Excavation	N/A	Cubic Yard		N/A
3	310000 – Earthwork: Imported Gravel Fill	N/A	Cubic Yard		N/A
4	310000 – Earthwork: Imported 3/4 inch Crushed Stone	N/A	Cubic Yard		N/A
5	310000 – Earthwork: Imported Ordinary Ffill	N/A	Cubic Yard		N/A
6	310000 – Earthwork: Ordinary Fill (On-Site Source)	N/A	Cubic Yard		N/A
7	310000 – Earthwork: Lean Concrete	N/A	Cubic Yard		N/A
8	310000 – Earthwork: Off-Site Disposal of Excess Excavated Fill Material at an In-State Unlined landfill	N/A	Ton		N/A
9	310000 – Earthwork: Off-Site Disposal of Excess Excavated Fill Material at an In-State Lined Landfill	N/A	Ton		N/A
10	310000 – Earthwork: Off-Site Disposal of Excess Excavated Fill Material at an In-State Asphalt Batch Plant	N/A	Ton		N/A
11	310000 – Earthwork: Removal and Off-Site Disposal of Reinforced Concrete	N/A	Ton		N/A

12	Division 33 – Utilities: Vertical rebuild of existing sewer/drainage structure	N/A	Linear foot		N/A
13	096510 Resilient Flooring and Accessories: Moisture mitigation. Refer to Section 096110 Vapor Mitigation at Slabs for requirements.	N/A	Square Feet		N/A
14	096560 Resilient Athletic Flooring: Moisture mitigation. Refer to Section 096110 Vapor Mitigation at Slabs for requirements.	N/A	Square Feet		N/A
15	096710 Resinous Flooring: Moisture mitigation. Refer to Section 096110 Vapor Mitigation at Slabs for requirements.	N/A	Square Feet		N/A
16	096810 Tile Carpeting: Moisture mitigation. Refer to Section 096110 Vapor Mitigation at Slabs for requirements.	N/A	Square Feet		N/A
17	096820 Sheet Carpeting: Moisture mitigation. Refer to Section 096110 Vapor Mitigation at Slabs for requirements.	N/A	Square Feet		N/A

2. The unit prices requested herein shall include their pro-rata share of all costs for the indicated items of work, including such items as overhead, superintendence, general conditions, profit, bond, labor, materials, payments to and coordination of subcontractors, equipment costs, disposal fees, and all other work incidental thereto.
3. Any unit price proposal that contains a unit price which is unduly high or low may be rejected as unbalanced, refer to Document 002113 – Instructions to Bidders.
4. The Base Bid shall include the estimated quantities listed above in addition to all work shown on the Drawings and as specified.
5. The total amount for estimated quantities above as applicable shall be included in the amount to be entered in the Form for General Bid, Paragraph B.

***THIS FORM MUST BE SUBMITTED WITH THE GENERAL BID FORM ***

NAME OF CONTRACTOR (PLEASE PRINT)

END OF APPENDIX

SECTION 012300
ALTERNATES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by Bidders and Filed Sub-Bidders, and stated on the appropriate Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Each General Bidder and each Sub-Bidder shall examine the Alternates generally defined herein and in the Drawings and Specifications and determine any modifications to his work caused by any Alternate whether or not his particular trade Section is mentioned herein.
- B. Listing of Alternates on Bid Forms:
 - 1. Each Filed Sub-Bidder shall enter in the FORM FOR SUB-BID only the amount of the addition or subtraction necessitated by the Alternate that pertains to the work of his trade.
 - 2. General Bidders shall enter a single amount in the appropriate space provided in the FORM FOR GENERAL BID, which total amount shall consist of the Filed Sub-Bidders' amounts and the amount for all work to be performed by the General Contractor.

3. Work of Sections that are affected by Alternates but which are not designated as Filed Sub-Bid Sections shall be included in the work of the General Contractor.
- C. Alternates will be considered in numerical sequence as required by Chapter 149, Section 44G of the Massachusetts General Laws.

1.5 COORDINATION

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
 2. The amount listed for each alternate shall include all costs related to coordination, modification and adjustments of the Work associated with that alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections affected by alternates contain requirements for materials necessary to achieve the work described under each alternate.

3.2 SCHEDULE OF ALTERNATES

- A. Add Alternate #1: TBD.

END OF SECTION

SECTION 012400
SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes requirements for the following procedures:
 - 1. Preparation and submittal of the Preliminary and Final Schedule of Values
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Requirements for construction schedules: Section 013200 – Construction Progress Documentation.
 - 2. General procedures for submittals: Section 013300 – Submittal Procedures.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300 – Submittal Procedures.
- B. Schedule of Values:
 - 1. Schedule of Values shall be typewritten on 8-1/2 by 11 inch white paper.
 - 2. Submit to the Architect three (3) copies of each Schedule of Values within 7 days of receipt of Notice to Proceed.

- C. List of Subcontractors and Sub-subcontractors: Attached to the Preliminary Schedule of Values shall be a list of the names, addresses (and whether individual, partnership or corporation) of each Subcontractor or Sub-Subcontractor who is to perform all or any part of each subdivision. In the event any Subcontractors, or Sub-subcontractors are not known at the time said schedule is prepared, an amended or supplementary list containing the names of the Subcontractors and Sub-Subcontractors involved and indicating their division of the Work shall be furnished to the Architect as soon as the information is available. A code number for identification on requisitions shall be used to identify the Contractor, each of the Subcontractors and subordinate Subcontractors, and shall be shown in each requisition where any part of the Work performed by the Contractor, such Subcontractor, Sub-Subcontractors or material supplier is incorporated in the amount of the requisition for which payment is requested.
- D. Monthly Updates: Submit to the Owner with the Schedule of Values on a monthly basis such schedules of quantities and costs, payrolls, reports, estimates, records, and other data as the Owner may request concerning work performed or to be performed under this Contract. The Schedule of Values shall be submitted at the same time as the updated CPM Schedule showing the current status of the work, as required under Section 013200 – Construction Progress Documentation.

1.5 SCHEDULE REQUIREMENTS

- A. General: Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project CPM Schedule. Provide line items for principal subcontract amounts, where appropriate, and for portions of the work designated in this Section.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section. Identify each line item by Specification Number and Title, and by portion of the Work of that Section where the Work of a Section is allocated to more than one line item.
- C. The Schedule of Values shall be arranged in vertical columns identified with titles, including Names Of Items; Original Amounts, Percent Completed To Date; Previous Payments; Current Requests; and Balance Not Yet Requested. A summary of the total amount due to date and the amount of the five percent retained shall be included in the statement which shall be signed by the Contractor. A separate sheet shall be included with each requisition showing status of work covered by approved Change Orders. The Schedule of Values shall be revised if later found by the Architect to be inaccurate.
- D. In preparing the Schedule, each sub-division or classification of the Work shall be identified by code number referring to each individual Section (or Sub-Section where applicable) of the Specifications. The Schedule of Values shall be prepared in accordance with AIA Documents G702 and G703.
- E. Initial values will be recognized to be an accurate accounting of the value of the work. Upon request by the Architect, support values given with data that will substantiate their correctness.
- F. Identify quantities of designated materials or materials stored on which payment is expected to be made.
- G. Use monthly submissions of Schedule of Values only as basis for Contractor's Application for Payment.

1.6 PREPARING SCHEDULE OF VALUES

- A. General Procedures:
 - 1. Prepare Preliminary Schedule of Values for review by Architect, Owner and Owner's Project Manager.
 - 2. Incorporate requested modifications to produce a Final Schedule of Values, which will become the basis for documenting the progress of the Work with each Application for Payment.
 - 3. Update Final Schedule of Values as necessary to reflect changes in the Work.
- B. Itemize separate line item cost for each of the general cost items as specified in this Section.
- C. Breakdown installed costs into:
 - 1. Delivered cost of product
 - 2. Total installation cost, with overhead and profit.
 - 3. Construction phase.
 - 4. Note that the Owner is exempt from Sales and Use Tax for all materials incorporated into the Work.
- D. For each line item which has installed value of more than \$20,000.00 breakdown costs to list major products, components, or operations under each line.
- E. Sum of costs of all items listed in schedule shall be equal to total Contract Sum.
- F. Each item shown on an Application for Payment Schedule of Values shall also appear on the CPM Schedule.
- G. Contractor shall coordinate the schedule of values with the MSBA Propay Codes.

1.7 LINE ITEMS FOR SCHEDULE OF VALUES

- A. Work Covered in Division 1: Itemize separate line item cost for each of the following general cost items:
 - 1. Builder's Risk Insurance
 - 2. Performance and Payment Bonds for General Contractor and Filed Subcontractors.
 - 3. Field engineering; photographic documentation.
 - 4. Coordination; project management.
 - 5. Coordination drawings.
 - 6. Preparation of construction schedule and periodic updates.
 - a. If periodic updates of schedule are not performed in a timely manner, the amount shown on the Schedule of Values for this line item shall be forfeit.
 - 7. Weather protection; temporary fence.
 - 8. Temporary heat, water, power and lighting.

9. Temporary office facilities; temporary sanitary facilities.
 10. Construction aids, including staging, scaffolding, shoring.
 11. Project sign.
 12. Indoor air quality provisions.
 13. Construction waste management.
 14. Cutting and patching; selective demolition
 15. Final cleaning.
 16. Punchlist preparation and response.
 17. Maintenance of as-built documents for architectural and site work; preparation of closeout documents.
 18. Commissioning coordination activities.
 19. Overhead.
 20. Sustainable Design Provisions.
 21. Record Drawings.
 22. Other items of work as requested by the Architect or Owner.
- B. Work Covered in Divisions 2 through 50: Provide at least one separate line item for each Section of the Specifications. Section line items shall be further subdivided into separate line items as follows:
1. Subdivide each line item into separate line items for individual floors of the project where applicable.
 2. Identify material costs separately from labor costs.
 3. Provide separate line items for the following where applicable:
 - a. Submittals
 - b. Maintenance of as-built documents for mechanical and electrical work
 - c. Preparation of closeout documents
 - d. Operations and Maintenance Manuals;
 - e. Training
 - f. Other items of work as requested by the Architect or Owner.
 4. For mechanical and electrical work, provide the following additional separate line items where applicable:
 - a. Commissioning coordination activities other than demonstration of FPT to the Commissioning Firm
 - b. Commissioning coordination activities associated with demonstration of FPT to the Commissioning Firm
 5. For each line item which has installed value of more than \$20,000.00 break down costs to list major products, components, or operations under each line.

PART 2 - PRODUCTS [NOT USED]

omr architects inc.
AUGUST 15, 2012

CONCORD CARLISLE HIGH SCHOOL
CONCORD, MA

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 013100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Responsibility for coordination of the Work.
 - 2. Surveying and engineering.
 - 3. Coordination Drawings.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Survey information available to bidders: Section 011100– SUMMARY OF THE WORK
 - 2. General requirements for submittals: Section 013300 – SUBMITTAL PROCEDURES.

1.3 SUBMITTALS

- A. Prepare and submit documentation in accordance with Section 013300 – SUBMITTAL PROCEDURES.
- B. Drawings:
 - 1. Survey of base plate elevations and anchor bolt locations.
 - 2. Survey of as-built conditions: Certified survey showing all as-built dimensions, locations, angles and elevations of construction, to be submitted at Substantial Completion of the Work.
 - 3. Coordination Drawings as described in this Section.
- C. Certifications required for Work described in this Section:
 - 1. Field Engineering: Submit name and address of surveyor and professional engineer to Architect.

1.4 COORDINATION

- A. General: The Contractor shall be responsible for the proper fitting of all work and the coordi-

nation of the operations of all trades, Subcontractors, material installers and equipment engaged upon the Work. He shall perform or cause Subcontractors to perform all cutting, fitting, adjusting and patching necessary to make the several parts of the Work come together properly and to fit the Work to receive or be received by that of other contractors.

- B. Project Supervision: The Contractor shall give his personal supervision to the Work and shall assign the following site staff for the Project. The Owner has the right to replace assigned personnel in accordance with General Conditions.:
1. 1 Full-time Superintendent: Superintendent licensed in the Commonwealth of Massachusetts, with the authority to act on behalf of the Contractor. The Superintendent shall supervise the Work at all times throughout the duration of the Project.
 2. Quality Control Monitor: A member of Contractor's full-time on-site staff assigned to monitor the quality of the Work. The Quality Control Monitor may also be assigned to oversee all requirements of section 018113, MA-CHPS, including commissioning, documenting of construction waste removal, and building flush out.
 3. 1 Full Time Project Manager: The Contractor shall also provide a competent, experienced, on-site full time project manager for the duration of the project for the management, proper coordination and expediting of Work.
- C. Coordination with Subcontractors: The Contractor shall be in charge of the entire Work and shall be responsible for the prompt coordination of all trades, including his own forces and his various Subcontractors, as well as the Owner's separate contractors, if they are on the job during the Contractor's operations, and shall become fully familiar with all work required under the Contract.
1. The above notwithstanding, each Subcontractor shall assume responsibility for the correctness and adequacy of his work. Each Subcontractor shall be responsible for and pay for all damage done by his work and his workers.
 2. No Subcontractor shall be permitted on the site without the Superintendent present to supervise the Work.
- D. Care shall be given to the proper scheduling, delivery, and installation of items to be built into rough construction which will affect the latter portions of the Work, such as anchors, pipe sleeves, inserts, conduit, pipes, lugs, clips, brackets, braces, hangers, bolts, miscellaneous metal, and similar items. These items are not necessarily specified under the trade Section under which they are to be installed. The Contractor shall ascertain that all are properly installed in their correct locations at the proper time, so as to prevent cutting and patching of finished work.
- E. The Contractor shall be fully responsible for coordination of general construction work with that of Subcontractors for PLUMBING, ELECTRICAL, HEATING AND VENTILATING and all other specialized trades. He shall investigate, together with the Subcontractors involved, the routing of pipe, ductwork, and conduit with particular attention to interference of structural members, other pipes, ducts, and conduit cuts, headroom conditions, door and window openings and swings, pipe chases, and similar features of the building which may affect installation and proper functioning of such items.
- F. Changes in design locations which may be necessary in the routing of pipes and ducts, or in the location of any mechanical, electrical or other equipment or in the location of other building elements, shall be anticipated and made prior to installation. Additional compensation will not be allowed for costs incurred as a result of the Contractor's failure to anticipate the necessity for such changes.

- G. There shall be no change or variation in ceiling height, wall layout, shaft, chase, furring or other dimensions shown on Drawings without the specific written approval of the Architect.
- H. The Contractor's responsibility for the coordination of all work under the Contract shall be complete, and shall extend to all modifications in the Work, whether or not such modifications entail a change in the Contract Price. Where the Contract Documents allow an optional material or method of performing a portion of the Work, or where the Contractor is ultimately allowed or directed to perform a part of the Work using a substitute material or method, the Contractor shall provide all other coordination and additional work that such change necessitates, without any additional cost to the Owner.

1.5 SURVEYING AND ENGINEERING, GENERAL

- A. The Contractor shall employ a project engineer who is a qualified land surveyor registered to practice in the Commonwealth of Massachusetts, who shall establish and maintain grades and levels and permanent bench marks. In addition, the Contractor shall designate one person from within his organization, with engineering experience, who shall do the usual engineering work required, including leveling, checking, and verifying wall and partition lines, elevations.
- B. Prior to commencement of any excavation or filling work on the site, the project engineer shall check locations of all structures and other fixed items with regard to property lines and other existing conditions. The Contractor shall be fully responsible for reporting to the Architect discrepancies between the dimensions and/or locations indicated on the Contract Drawings and those as they actually exist on the site.
- C. After verification of all dimensions and locations, the Contractor shall submit to the Architect such verification in written form bearing the professional stamp of the surveyor. Failure to do so shall mean that the Contractor assumes responsibility for all corrective measures required at no addition to the Contract amount.
- D. The Contractor shall lay out the Work and shall be responsible for all lines, elevations, and measurements of the building, grading, paving and other work under the Contract. He shall exercise proper precaution to verify the dimensions shown on the Drawings before laying out the Work and will be held responsible for any error resulting from his failure to exercise such precaution.

1.6 FIELD ENGINEERING REQUIREMENTS

- A. General: Provide professional field engineering services, establish grades, lines and levels, by use of recognized engineering survey practices.
 - 1. Submit surveys and documentation as described herein.
- B. Scope of Field Engineering:
 - 1. Site features:
 - a. Existing grades, including grades immediately adjacent to existing building.
 - 2. Structural elements: For each column, a precise base plate elevation and horizontal location shall be established. After the anchor bolts have been set in the foundations and leveling plates have been set in grout, the top surface of each leveling plate shall be surveyed to determine the following locations. Submit survey data to the Architect for review and approval prior to fabrication of structural steel.
 - a. Elevation of top surface of each leveling plate.

- b. Precise position of the center of each anchor bolt in each leveling plate.
- C. Qualifications of Surveyor or engineer: Qualified engineer or registered land surveyor, acceptable to Architect and the Owner.
 1. Registered professional engineer of the discipline required for the specific service on the Project, licensed in the Commonwealth of Massachusetts.
- D. Survey Reference Points:
 1. Datum: Location of control datum to be used as reference point for horizontal and vertical survey measurements is shown on Drawings.
 2. Locate and protect control and reference points prior to starting sitework, and preserve all permanent reference points during construction.
 - a. Make no changes or relocations of control points without prior written notice to Architect.
 3. In the event that any reference point is lost or destroyed, or requires relocation due to necessary changes in grades or construction, perform the following actions without delay:
 - a. Report change to Architect immediately.
 - b. Replacement of reference point shall be performed by surveyor, as directed by Architect.
 4. Project Survey Requirements:
 - a. Establish a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.
 - b. Establish lines and levels, locate and lay out by instrumentation and other appropriate means.
 - c. Verify layouts periodically using the same means as those by which they were established.
- E. Records:
 1. Maintain a complete, accurate log of all control and survey work as it progresses.
 2. Prepare and submit a survey of existing conditions and a final survey of as-built conditions containing all relevant horizontal and vertical dimensions and reference point data.

1.7 BUILDING ENVELOPE COORDINATION DRAWINGS

- A. Provide coordination drawings illustrating details for Masonry, Air/ Vapor Barrier Systems, Waterproofing Systems, Windows, Curtainwall, Louvers, Storefront, Roofing Systems, Metal Siding Systems, Exterior Frame Systems.
- B. GC shall coordinate and produce color coded coordination drawings of each system showing interface between each building envelope system.
- C. Coordination drawings shall include, but not be limited to:
 1. Foundation Conditions
 2. Footing Conditions
 3. Edge of floor slab conditions
 4. Roof Edge Conditions
 5. Roof to Wall Conditions
 6. Opening Conditions (i.e. Window, Curtainwall & Storefront & Vent)
 7. Expansion Joint Conditions
- D. Coordination drawings must be completed prior to system application on the mock-up(s).

- E. Coordination Drawings shall be reviewed and signed off by each building envelope trade.
- F. Refer to additional applicable requirements specified herein below for mechanical coordination drawings.

1.8 MECHANICAL COORDINATION DRAWINGS

- A. The Contractor shall be responsible for the coordination of all mechanical and electrical work with architectural requirements including ceiling layouts. Well in advance of commencing work in any area and before materials are fabricated or work begun, he shall submit to the Architect complete Coordination Drawings in the form of colorized PDF's, submitted electronically with 1 hard copy print to the Architect, and 1 hard copy print to the Engineer, in a scale not less than 1/4" = 1'-0". Congested areas and sections through shafts shall be at a scale not less than 3/8" = 1'-0".
 - 1. Coordination Drawings are considered Informational Submittals. Refer to Section 013300 – SUBMITTALS for requirements for preparation and submittal of Informational Submittals.
- B. Coordination Drawings shall indicate the necessary offsets for all ductwork, piping, conduit, and other items to clear the work of all other trades, and structure, and to maintain the required ceiling height, ceiling layout and partition layout.
- C. Prepare Coordination Drawings as follows: Provide PDF's and 1 hard copy print to the Architect and Engineer concurrently with each trade's additions, and with clearly marked conflicts and questions on said PDF's and prints.
 - 1. The background for coordination drawings shall show the reflected ceiling plan.
 - 2. Contractor shall require HEATING AND VENTILATING Subcontractor to prepare original Drawings showing all ductwork, hot water and other heating lines, based on approved Sheet Metal Fabrication Drawings and related mechanical submittals.
 - 3. Contractor shall distribute them to the Architect and the Plumbing Subcontractor for the next step.
 - 4. Contractor shall then require PLUMBING Subcontractor to indicate all his equipment and plumbing lines on these.
 - 5. Contractor shall then require FIRE PROTECTION Subcontractor to indicate his equipment and piping on these.
 - 6. Contractor shall require the ELECTRICAL Subcontractor to indicate his equipment and conduit lines on the same Drawings.
 - 7. Contractor shall resolve conflicts and then submit in PDF and 1 hard copy to the Architect for review.
 - 8. Submit complete final set of coordination drawings for record purposes in PDF and 1 hard copy.
- D. Coordination Drawings shall bear the signature of all subcontractors involved indicating that all space conditions have been satisfactorily resolved. In addition, the Drawings shall bear the Contractor's stamp bearing the notation "Drawings Have Been Checked and Coordinated with all Trades". Drawings without these notations, or Drawings submitted more than 120 days after the execution of the Contract, will not be accepted or reviewed by the Architect.
- E. If any space conflicts cannot be resolved by the Contractor, he shall immediately notify the Architect.
- F. Coordination Drawings are for the Contractor's and Architect's use during construction and shall not be construed as replacing any Shop, "As-Built", or other Record Drawings required

elsewhere in these Contract Documents.

- G. Architect's review of Coordination Drawings shall not relieve General Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.
- H. Access panel coordination: Show locations and sizes of all access panels for all trades on Coordination Drawings.
- I. Refer to Section 011400 – Work Restrictions for Project Electronic Files to be made available for use by the Contractor in the preparation of Coordination Drawings.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION [NOT USED]

END OF SECTION

SECTION 013119

PROJECT MEETINGS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Organizational meetings.
 - 2. Project meetings.
 - 3. Pre-Installation conferences
 - 4. Post-construction meetings
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Requirements for construction schedules: Section 013200 Construction Progress Documentation.

PART 2 - PRODUCTS

2.1 ORGANIZATIONAL MEETINGS

- A. General: The Owner's Project Manager will schedule pre-construction organizational meetings, periodic Project meetings, specially called meetings throughout the progress of the Work, and post-construction meetings. Representatives of the Contractor shall attend all such meetings. Subcontractors shall attend only if requested by the Architect or the Owner's Project Manager.
- B. Pre-Construction Meeting: Immediately following award of Contract, the Architect will call one or more preliminary organizational meetings, during which detailed procedures will be worked out for submission and review of Shop Drawings and samples, format and extent of the Progress Schedule and Schedule of Values, format and methods for progress payment requisitions, channels of communication between Owner, the Owner's Project Manager, Architect's and Contractor's personnel, and other routines to be followed during construction. The Architect will then issue a directive summarizing such procedures.

2.2 PROJECT MEETINGS

- A. The Architect shall schedule and meet regularly with the Owner, the Owner's Project Manager and the Contractor at the site of the Work during the course of the Contract for the purpose of progress review, coordination of Shop Drawing schedules, sample submittals, and other items of work requiring such coordination. The dates of such meetings shall be as mutually agreed upon between the Owner, the Owner's Project Manager, Contractor and the Architect. Contractor shall require Subcontractors to attend such meetings if requested by the Architect.
- B. The Owner's Project Manager shall take minutes of such meetings and shall distribute copies of the minutes to all concerned.
- C. Contractor's and Subcontractor's representatives attending such meetings shall include the job superintendent or other responsible party approved by the Architect. Such representatives shall be empowered to make, at these meetings, definite decisions binding upon their respective employers regarding all matters pertaining to work under this Contract.
- D. The Contractor shall furnish the Owner, the Owner's Project Manager and the Architect, in writing, the names, addresses, and telephone numbers of Contractor's and principal Subcontractors' personnel to be contacted in the event of an out-of-hours emergency at the building site. He shall also maintain a similar list readily visible from the outside of the field office.

2.3 PREINSTALLATION CONFERENCES

- A. Pre-Installation Conferences: Conduct pre-installation conferences at site prior to construction activities that require coordination.
 - 1. Schedule the conference to occur after submittals have been approved for the materials or systems.
 - 2. Installers, manufacturer's representatives, and fabricators of materials or systems affected shall be required to attend. Advise Architect of scheduled meeting dates.
 - 3. Do not allow affected work to proceed if the conference cannot be successfully concluded. Initiate actions necessary to resolve impediments to performance of the work and reconvene the conference at the earliest feasible date.
- B. Work for which pre-installation conferences will be required include the following. Additional pre-installation conferences may be required by specifications in Sections 2 through 50, and by the Owner or Architect during the progress of the Work:
 - 1. Concrete work including finishes.
 - 2. Steel erection.
 - 3. Air barrier system.
 - 4. Roofing.
- C. Refer to individual specifications sections for additional requirements.

2.4 POST-CONSTRUCTION MEETINGS

- A. Not less often than every three months, starting with the date of Substantial Completion and continuing for one year thereafter, representatives of the Contractor and the Subcontractors for FIRE PROTECTION, PLUMBING, HVAC, and ELECTRICAL Work shall meet with the Architect and Owner's Project Manager at the site in accordance with an agreed-upon sche-

- dule in order to inspect the Work and to plan correction of any deficiencies or failures discovered during this period.
- B. Representatives of the Contractor and Subcontractors attending such meetings shall be the same persons, or shall have the same powers and authority, as those attending job meetings prior to the date of Substantial Completion.
 - C. Post-Warranty Meeting: Coordinate with Owner and attend meeting to be held with Commissioning Agent.

END OF SECTION

SECTION 013200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Time for Completion and Liquidated Damages.
 - 2. Sequencing requirements.
 - 3. Requirements for scheduling closeout activities.
 - 4. Critical Path Method Schedule preparation and submission.
 - 5. Photographic documentation of construction.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Section 011100 – SUMMARY OF WORK: Hours of work and related scheduling criteria.
 - 2. Section 012400 – SCHEDULE OF VALUES: Allocation of portions of the Work as line items in applications for payment.
 - 3. Section 013100 – PROJECT MANAGEMENT AND COORDINATION: Contractor responsibility for coordinating the Work.
 - 4. Section 013119 – PROJECT MEETINGS: Scheduling construction-related meetings.
 - 5. Section 013300 – SUBMITTAL PROCEDURES: Coordination of submittal schedule with construction.
 - 6. Section 014000 – QUALITY REQUIREMENTS: Special sequencing requirements required for inspection of building components prior to concealment.
 - 7. Section 017700 – CLOSEOUT PROCEDURES: Requirements for Substantial Completion and Final Completion.

1.3 SUBMITTALS

- A. Preliminary Construction Schedule: Within 10 calendar days following receipt of the Notice to Proceed, submit a CD containing an electronic copy (PRX) and two paper copies for review by the Owner, Project Manager and the Architect. This preliminary schedule shall include the project contract dates, milestones, long lead items, major work activities and a critical path to

completion. (approximately 100 to 150 schedule activities)

1. Acceptance of the Preliminary Construction Schedule by the Owner, Project Manager and Architect shall be a prerequisite to certification of the first Application for Payment.
- B. Complete and Detailed Construction Schedule: Within 45 calendar days following receipt of the Notice to Proceed, and at least 15 calendar days prior to submitting the second Application for Payment, submit a CD containing an electronic copy (PRX) and two paper copies of the complete and detailed schedule, to show entire schedule for entire construction period.
 1. Acceptance of the Complete and Detailed Construction Schedule by the Owner, Project Manager and Architect shall be a prerequisite to certification of the second Application for Payment.
- C. Monthly Schedule Update: With each monthly Application for Payment, submit a schedule update of the accepted Complete and Detailed Construction Schedule accompanied by a written narrative reporting on the progress of the Work and a CD containing an electronic copy (PRX) and two paper copies of the Monthly Schedule Update.
 1. Acceptance of the Updated Schedule each month by the Owner, Project Manager and Architect shall be a prerequisite to certification of the monthly Application for Payment.
- D. Daily Construction Field Reports: Submit two copies of the current week's field reports to the Owner's Project Manager and the Architect at the end of each week. (Electronic submission is acceptable)
- E. Recovery Schedule: Prepare recovery schedule as needed and as directed by Architect.
- F. 2-Week Look Ahead: Provide 2-week look ahead for scheduled work.
- G. Special Reports: Submit two copies of special reports of unusual events at the site directly to Owner's Project Manager and a copy to the Architect, on the day of the occurrence. Distribute additional copies of report to parties affected by the occurrence.
- H. Digital Photographs:
 1. Photographic documentation of construction as specified herein.
 2. Copies of prints:
 - a. Submit one electronic and two hardcopy prints of each photographic view within seven days of taking photographs.
 - b. Field Office Prints: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs same as for those submitted to Architect
 3. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
 - a. Name of Project.
 - b. Name and address of photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken if not date stamped by camera.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier.

4. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.

1.4 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

- A. It is understood and mutually agreed, by and between the Contractor and the Owner, that the date of commencement and the time for completion for each phase are essential conditions of this Contract, and it is further mutually understood and agreed that the Work embraced in this Contract shall be commenced by the date specified therein.
- B. The Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the Owner, that the time for the completion of the Work in each phase described herein is a reasonable time for the completion of the same, taking into consideration the usual industrial and climatic conditions prevailing in this locality.
- C. It is further agreed that time is of the essence of each and every portion of the Contract and of the Contract Documents wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new limit fixed by such extension shall be of the essence of this Contract. Provided, that the Contractor shall not be charged with liquidated damages for any excess cost when the delay in completion of the Work is due:
 1. To any preference, priority, or allocation order duly issued by the Government;
 2. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including, but not restricted to: Acts of God, or of the public enemy; acts of the Owner; acts of another Contractor in the performance of a Contract with the Owner; fires, floods, epidemics, quarantine restrictions, strikes, and freight embargoes.
 3. To any delays of Subcontractors or suppliers occasioned by any of the clauses specified in subparagraphs 1. and 2. of this Paragraph.
- D. Provided, further, that the Contractor shall, within ten (10) days from the beginning of such delay, unless the Owner shall grant a further period of time prior to the date of final settlement of the Contract, notify the Owner, in writing, of the causes of the delay, who shall ascertain the facts and extent of the delay and notify the Contractor within a reasonable time of its decision in the matter.
- E. If the Contractor shall neglect, fail or refuse to substantially complete the Work within the time herein specified or any proper extension thereof granted by the Owner, the Contractor does hereby agree, as part of the consideration for the awarding of this Contract, to pay to the Owner the amount specified in the Agreement (or if not specified, then actual damages amount), not as a penalty but as liquidated damages for such breach of contract as herein set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the Work.
- F. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodic estimates. This remedy to the Owner shall be cumulative to the remedies available to the Owner under law.

- G. Work Executed after Substantial Completion: The Architect will continue to execute their administrative responsibilities for the Contract, as provided in the General Conditions, beyond the specified date of Final Completion.
 - 1. If, due to delays on the Contractor's part in the completion of the Work, the Architect is required to continue in this role beyond the specified date for Final Completion, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional administration duties, until the Work is complete.
 - 2. Refer to Section 011400 – Work Restrictions, for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.
- H. Liquidated Damages: Refer to INSTRUCTIONS TO BIDDERS, for provisions for, and amounts of, Liquidated Damages.

1.5 SEQUENCING REQUIREMENTS

- A. Exterior Envelope Construction and Inspection: Schedule the installation of materials comprising the exterior walls and roofs to minimize exposure of construction materials to damage by ultraviolet light, wind and weather. Notify the Architect prior to concealment of air barrier, to permit inspection and testing. Refer to Section 014000 – QUALITY REQUIREMENTS, and individual technical specification sections for specific requirements.
- B. Indoor Air Quality Provisions: Refer to Section 018119 – INDOOR AIR QUALITY REQUIREMENTS, for the following activities that will have an impact on scheduling:
 - 1. Sequencing required to minimize adsorption of airborne contaminants on new surfaces.
 - 2. Sequence of building flush-out with respect to completion, testing and balancing of mechanical systems.
- C. Commissioning: Refer to the Owner's commissioning agent, for inspections, testing and related activities to be performed by Commissioning Agent during and after construction.

1.6 SCHEDULING REQUIREMENTS FOR CLOSEOUT

- A. General: Closeout scheduling shall be carefully coordinated with activities required for Commissioning and the approved Indoor Air Quality Management Plan. The following sequence of activities is a summary of requirements of many trades. Refer to other Division 1 Sections and Technical Sections for additional information as indicated.
 - 1. The Contractor's attention is brought to the fact that no HVAC system shall be started up before the completion of all major finishes, casework installation and final cleanup.
- B. Initial Closeout Activities:
 - 1. Commissioning Coordination Meeting: Schedule meeting well in advance of anticipated date for start-up of mechanical and electrical systems. At this meeting, the Commissioning Firm will distribute Pre-Functional Performance Test (PFPT) checklists, and scheduling requirements will be reviewed. Refer to Section 013119 – PROJECT MEETINGS.
 - 2. Confirmation of Completion of Finishes, Casework and Cleaning: The Contractor submit a letter confirming that all major finishes have been applied, all casework is installed and final cleanup has been completed.

- C. System Start-Up, Building Flush-out and Testing and Balancing.
 - 1. The HVAC system shall be started up with new filters as specified in Section 230000 – Heating, Ventilating and Air Conditioning.
 - 2. Building Flush-Out: As part of the Indoor Air Quality Plan, the HVAC system shall be run for 28 calendar days with 100 percent fresh air. Disable carbon dioxide sensors during this time. Refer to Section 230000 – Heating, Ventilating and Air Conditioning for additional requirements for system operation.
 - 3. Testing and Balancing: After the building flush-out is complete, replace HVAC system filters, adjust HVAC system for normal operation and conduct tests for balancing the system.

- D. Substantial Completion: When system start-up and the related activities specified above have been completed on all mechanical and electrical systems, notify the Architect that the Project is Substantially Complete. Refer to Section 017700 – PROJECT CLOSEOUT, for additional requirements for Substantial Completion.

PART 2 - PRODUCTS

2.1 CRITICAL PATH METHOD SCHEDULE (CPM) GENERAL

- A. The purpose of the Construction Schedule shall be to:
 - 1. Assure adequate planning, scheduling and reporting during execution of the work by the Contractor;
 - 2. Assist the Contractor, Architect, Project Manager and Owner in monitoring the progress of the work and evaluating proposed changes to the Contract and the Construction schedule;
 - 3. Assist the Owner, Project Manager, Architect and the Contractor in the preparation and evaluation of the Contractor's monthly progress payments.

- B. The Construction Schedules shall employ the Critical Path Method (CPM) for the planning, scheduling and reporting of the work to be performed under the contract and shall meet the following requirements:
 - 1. The schedule shall be produced utilizing the most current version of Primavera P3 Project Planner software system or equivalent and the data fully transferable to Primavera Project Planner.
 - 2. The type of schedule shall be time scaled Precedence Diagramming Method (PDM) with Finish to Start with zero (0) lag dependency relationship.
 - 3. Activity duration shall be in units of whole working days and shall be limited to a minimum of one (1) and a maximum of twenty (20) working days for each activity.
 - 4. The schedules and the corresponding completion dates shall meet the contract duration (remaining contract duration for the monthly updates) of the project. Failure by the Contractor to include any element of work required for performance of the Contract shall not excuse the General Contractor from completing all work within the Contract Time. Under no circumstances, shall the Contractor be entitled to an equitable adjustment in the event of failing to achieve an early completion schedule.
 - 5. The Contractor shall review the planned activity coding and activity ID format with the Project Manager prior to the development of the Detailed Construction Schedule. At a minimum, the Project Manager will require the following coding: Area, Location/Phase/Shift, Work Type/Trade, CSI Code, and a separate code for each subcon-

tractor.

6. Proposed durations assigned to each activity shall be the Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity, utilizing the appropriate workday calendar.
7. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures and/or precipitation to ensure completion of all work within the Contract time. Seasonal weather conditions shall be determined by an assessment of average historical climatic conditions based upon the preceding ten (10) year records published for the locality by the National Ocean and Atmospheric Administration (NOAA).
8. The OPM's acceptance of the Construction Schedule shall not relieve the Contractor of responsibility for timing, planning and scheduling of the Work, nor impose any duty on the Architect or Owner with respect to the timing, planning or scheduling of the Work.

2.2 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Within 10 calendar days following receipt of Notice to Proceed, prepare and submit for review prints and CD of the Preliminary Construction CPM Schedule covering the first 90 days of construction. The schedule shall be neatly organized and plotted, time-scaled from left to right on standard size sheets. The Preliminary Construction Schedule shall cover the following phases and/or activities:
 1. Proposed mobilization, procurement and planned construction within the first 90 days after Notice To Proceed.
 2. Include a summary bar for major areas of the remainder of the Work and a cash requirement prediction based on indicated activities.
- B. The Preliminary Schedule shall be incorporated into the Complete and Detailed Schedule including all revisions directed by the Owner, Project Manager and Architect.

2.3 COMPLETE AND DETAILED CONSTRUCTION SCHEDULE

- A. Prepare and submit a comprehensive, fully developed Complete and Detailed CPM Construction Schedule within 45 days after Notice to Proceed and at least 15 days prior to the second Monthly application.
 1. The Complete and Detailed schedule shall incorporate the accepted Preliminary Construction Schedule with the Owner/Project Manager/Architect's comments
 2. Schedule shall be neatly organized and plotted time scaled from left to right on Project standard size sheets with suitable notation relating the interface points among sheets.
 3. The General Contractor's Schedule shall consist of, but not be limited to, the following:
 - a. Proposed procurement, submittal preparation, submittal review, fabrication & delivery, construction, testing, commissioning, and permitting activities.
 - b. Proposed durations for activities.
 - c. Proposed sequencing of activities (predecessors & successors).
 - d. Milestone events as required by the Contract Documents and Division 1 of the Specifications.
 4. The following shall be depicted on the Schedule for each activity:
 - a. Concise description of the work represented by the activity (maximum forty-eight (48) characters). The work related to each activity shall be limited to one work trade and one area. All descriptions shall include area designations.
 - b. In developing the Schedule, the Contractor shall be responsible for assuring that

- subcontractor and supplier work at all tiers, as well as its own work, is included in the Schedule.
- c. The Schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. The Contractor shall be responsible for assuring that all work sequences are logical and the Schedule shows a coordinated plan of the work.
 - d. Each activity shall have only one responsible party and will be coded accordingly.
 - e. Labor Resources will be included and tracked for all 'construction' activities in the "Complete and Detailed Construction Schedule". Each activity should contain adequate detail to determine and track the labor resources needed to complete the work as scheduled. Labor resources may be input as "Crews or partial crews" by trade to simplify the development of the schedule. If crew loading is used, typical crew sizes must be included for each trade in the baseline schedule narrative. This will allow for the reasonable assessment of labor resources necessary to complete the work as sequenced and scheduled.
 - f. For specific work activities where "Key Equipment" is required, such as crane(s) during steel erection, man-lifts or other critical equipment that is critical to phasing or sequencing of the work, the corresponding work activities in the schedule will be appropriately coded to allow for reasonable assessment and tracking of the adequacy of the planned "key equipment" and its movement through the project.
5. For the purposes of utilizing schedule targets, activity id's shall not be modified.
 6. The schedule shall employ retained logic.
 7. Any float suppression techniques identified shall be corrected by the Contractor.
 8. The Contractor shall utilize logic, durations, and appropriate calendar assignment to forecast dates, not activity constraints.

2.4 MONTHLY SCHEDULE UPDATE REPORTS

- A. Monthly Schedule Update Report: Evaluate the status of the work as of the 25th of each month to show actual progress and to identify problem areas. Update the Complete and Detailed Construction schedule and print a schedule summary. Include approved Change Orders and Construction Change Directives within the updated schedule
- B. The Contractor shall furnish sufficient forces, offices, facilities and equipment at no additional cost to the Owner, and shall work such hours as necessary, within any local restrictions or agreements incorporated into the Contract, to ensure the prosecution of the work in accordance with the current monthly Project Schedule Update. Should the monthly update show that the Contractor is fourteen (14) or more work days behind schedule, the Contractor shall prepare a Recovery Schedule at no additional cost to the Owner explaining and displaying how the General Contractor intends to reschedule the work in order to regain compliance with the contract. The provision of this paragraph may include the Contractor increasing the hours of work, the number of shifts, overtime operations and/or the amount of construction plant and equipment or working on Saturdays, Sundays and holidays, within agreed working hours or variance granted, provided the General Contractor gives reasonable notice to the Owner.

2.5 RECOVERY SCHEDULE

- A. When directed by the Project Manager/Architect, the Contractor shall develop a Recovery Schedule with a detailed narrative for all the remaining work based on the last accepted Monthly Schedule Update. The Recovery Schedule shall represent the Contractors current work sequence plan and shall forecast completion of the remaining work within remaining contract durations. The Recovery Schedule narrative shall enumerate the Contractor's work

plan including increases to crew sizes and/or extended shifts to complete work with in remaining contract durations. The Recovery Schedule shall conform to requirements set forth in Paragraph 2.3 (Complete and Detailed Construction Schedule).

- B. The Contractor shall be responsible to develop mitigation measures for all delays, regardless of the responsibility for the delays, and to identify all time and cost impacts to the work associated with those mitigation measures. Whenever it is possible for the Contractor to mitigate delay without added cost, the Contractor shall do so. The Contractor shall mitigate all delays as efficiently and economically as possible, with the objective of minimizing both the time and cost impact of the delay, regardless of the responsibility of the delay.
- C. Unless circumstances otherwise require, the Contractor shall not pursue mitigation action for which it expects the Owner/Architect to be liable, prior to notifying the Owner/Architect and receiving Owner/Architect authorization to proceed with the mitigation action. Any action taken by the Contractor prior to receiving approval from the Owner/Architect shall be at the Contractor's risk.

2.6 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording events at the site. Report the following information, as applicable.
 - 1. List of subcontractors at the site, and approximate count of personnel.
 - 2. High and low temperatures, general weather conditions (when exterior work is in progress)
 - 3. Meetings and significant decisions.
 - 4. Accidents, unusual events, and emergency procedures.
 - 5. Stoppages, delays, shortages, losses.
 - 6. Meter readings and similar recordings.
 - 7. Services connected, disconnected.
 - 8. Orders and requests of governing authorities.
 - 9. Change Orders received, implemented.
 - 10. Equipment or system tests and start-ups.
 - 11. Partial Completions, occupancies.
 - 12. Substantial Completions authorized.
 - 13. Copies of weight tickets collected for demolition and construction debris removal indicating percentage recycled by weight.
- B. At the end of each week, compile the daily reports for the preceding week. Have the Contractor's Superintendent sign the daily reports and prepare a brief outline of the Work anticipated for the coming work week. Submit 1 copy to the Architect and 1 copy to the Owner/Owner's Project Manager and place 1 copy in the Project Record Documents file.

2.7 2 WEEK LOOK-AHEAD

- A. Provide a bar chart type, 2 week look-ahead schedule to review with the Owner's Project Manager and Architect during progress meetings.

2.8 CONSTRUCTION PHOTOGRAPHS

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. Photographer: Engage a qualified photographer to take construction photographs.
- C. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- D. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect and Owner.
- E. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- F. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect and Owner will inform photographer of desired vantage points.

PART 3 - EXECUTION

3.1 SCHEDULING THE WORK

- A. The Contractor shall perform the Work in accordance with the approved CPM Schedule.
 - 1. If during the progress of the job the Contractor misses a start date of an activity on the critical path, the Contractor shall, within five (5) working days, advise the Architect in writing of action proposed to bring the Work up to schedule, and shall submit a revised

CPM Schedule indicating such action, together with a typed list of such revisions.

2. If the Contractor fails to submit a revised schedule within the specified time or if the Architect is not convinced of the efficacy of the measures proposed, the Owner may, at its option, require the Contractor to accelerate the progress of the Work, without additional cost to the Owner, by increasing the work force or the hours of work, or by other reasonable means approved by the Architect.

END OF SECTION

SECTION 013300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Submittal schedule
 - 2. Product data
 - 3. Shop drawings
 - 4. Samples
 - 5. Colors and finishes
 - 6. Calculations
 - 7. Commissioning
 - 8. Informational submittals
 - 9. Action on submittals.
 - 10. Substitution requests.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Availability and restrictions for use of electronic copies of Contract Document: Section 011400 – Work Restrictions.
 - 2. Specific requirements for submittal of construction schedules: Section 013200 Construction Progress Documentation.
 - 3. Specific requirements for submittal of schedule of values: Section 012400 – Schedule of Values.
 - 4. Requirements for submittal of coordination drawings: Section 013100 – Project Management and Coordination.
 - 5. Submittal of final record drawings and other documents: Section 017839 – Project Record Documents.
 - 6. Submittal of product and procedural documentation: Section 018113- Sustainable Design Requirements; 018119-Indoor Air Quality Requirements

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action. Action submittals include product data, shop drawings and samples.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals of this kind may be required by the Architect to confirm the Contractor's compliance with submittal requirements. Submittals may be rejected for not complying with requirements. Informational submittals include calculations and other informational submittals described in this Section.
- C. Substitutions: Changes in products, materials, equipment and methods of construction from those required by the Contract Documents, as proposed by the Contractor and not considered "or equal".
- D. Or equal: Contractor proposed products, materials, and equipment that comply with specified material and performance requirements, but are not one of the named manufacturer's, suppliers, and distributors. Equal products, materials, and equipment shall identically match the physical appearance of specified items.

1.4 SUBMITTALS

- A. Submittal Schedule:
 - 1. Within 21 calendar days after signing the Agreement, prepare and submit for the Architect's approval a schedule of Shop Drawings, Product Data and Samples required to be submitted for the Work.
 - a. The schedule shall indicate by trade the date by which final approval of each item must be obtained, and shall be revised as required by conditions of work, subject to the Architect's approval.
 - b. The schedule shall be derived from the Contractor's CPM Schedule, but shall be submitted as a separate document, in addition to being part of the CPM line items.
 - 2. The Architect's review, including Consultant's review period, will not exceed 21 calendar days from the date on which the Architect receives the submission or the date that is provided on the General Contractor's submittal schedule, whichever is the latest. Contractor shall strictly adhere to the established dates set forth by the Schedule of Submittals specified above. On a weekly basis, the General Contractor is responsible for identifying, in writing, priority submissions to assist the Architect in facilitating an efficient review process that is in accordance with the Contractor's CPM schedule.
 - 3. Each submittal shall be made no later than 60 calendar days prior to the time for incorporation of the item into the Work, or earlier under the following conditions:
 - a. As required to furnish and deliver to the site the specific item or items required, with sufficient time to allow proper examination and review of such submittals.
 - b. If the item in question is to be incorporated in the work prior to the expiration of 60 calendar days from the time of execution of the Contract, the aforesaid written notice shall be submitted to the Architect immediately following the execution of the Contract.
 - c. Substitutions/ Or Equal: Each request for a substitution shall be made no later than 90 calendar days prior to the time for incorporation of the item into the Work.
 - 4. No item, material, article, system or piece of equipment requiring approval of the Archi-

tect shall be ordered or installed until such approval has been obtained.

5. Contractor shall provide the Owner's Project Manager, Architect, and Clerk of the Works with software and training for programs used to schedule, and track Shop Drawings, Samples, and RFI's.
- B. Product List for Color Selection: To facilitate the preparation of the color schedule, the Contractor shall submit, within forty-five (45) calendar days following signing the Agreement, unless otherwise extended by the Architect, a list of the names of the manufacturers whose products he proposes to use.
 1. List products for which color, finish, pattern, texture, or other related information is a consideration, including, but not limited to the following:
 - a. Exterior materials: Exterior concrete masonry units; factory-finished metal panels; factory finish for doors, windows and louvers.
 - b. Casework finishes: Solid and veneer wood with transparent finish; plastic laminate.
 - c. Interior finishes: Ceramic tile, acoustical ceiling tile, resilient flooring, carpet, paint.
 - d. Specialties available in a choice of colors: Toilet partitions; cubbies; operable panel finishes.
 - e. Other items for which the above properties affect the design.
 2. Products listed shall be as specified, unless substitution has been approved.
- C. Substitution and Or Equal Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 1. Substitution and Or Equal Request Form: Use facsimile of form provided at end of Section.
 2. Documentation: Show compliance with requirements for substitutions listed on the Substitution / Or Equal Request form, and additional requirements as may be requested by the Architect or as otherwise applicable. Submit specified product or system and clearly demonstrate in a side-by-side comparison the similarities and differences between the specified and proposed Substitution or Or Equal product or system. Absent this documentation, the request will not be reviewed by the Architect and be sent back rejected.
- D. Product Data, Shop Drawings, Samples, Schedules and other Submittals: Refer to individual Specification Sections for submittals required.
- E. Confirmation of contract between Contractor and printing company for reproduction of shop drawings as specified in this Section.

PART 2 - PRODUCTS

2.1 SUBMITTAL PREPARATION, GENERAL

- A. Preparation of Submittals: To receive consideration by the Architect, each submittal shall be accompanied with the Submittal Transmittal Form at the end of this section.
- B. Each submittal cover sheet shall contain a clear space approximately 80 square inches for stamps and Architect's comments. Each drawing shall contain a similar space as an addi-

tional border on the right or bottom.

- C. Distribution:
1. GC shall electronically deliver submittals to the Architect and its consultants, OPM, Clerk, and CxA (when applicable) in a format acceptable to the Architect.
 2. Simultaneously, GC shall deliver 1 hard copy print to the Architect and its consultants and one hard copy print to the clerk.
 3. Architect and consultants will review submittals, and the Architect will post reviewed submittals on GC file transfer site.
 4. Architect will hand deliver Clerk & GC hard copies at the weekly site meeting.
 5. GC is responsible for distribution to all trades.
 6. GC to deliver 1 hard copy of returned submittal to Clerk.
- D. File Transfer Service:
1. For the entire Construction Period Contractor shall provide, manage and maintain a High-Band Width Electronic File Transfer Service that is accessible via the Internet by a Web Browser such as Internet Explorer or Mozilla Fire Fox. The Contractor shall process submittals electronically, through one of the three following web-based construction administration database services:
 - a. Prolog Converge.
 - b. Submittal Exchange.
 - c. AEC Sync.
 - d. Or equal.
 2. The Contractor shall provide licensed seats/access to said database, for all of the Architect's Consultant's and OPM's CA Team Members, to facilitate electronic transmittal of all of the Project submittals, RFI's and Change Order Requests.
 3. All of the Project documentation compiled in this CA database, shall be made completely accessible to the Architect & Owner, for the entire duration of the Project, and then be submitted (in PDF form) to Architect and Owner, and become the property of the Owner, similar to all other Closeout documentation related to this Project.

2.2 PRODUCT DATA

- A. Manufacturers' Product Literature: For standard manufactured items, submit manufacturer's catalog sheets with illustrated cuts of the items to be furnished.
1. Include scale details, sizes, dimensions, performance characteristics, capacities and other pertinent information.
 2. Each submittal of product data shall be accompanied by an appropriate transmittal form with specific reference to the applicable paragraph in the Specifications.
 3. Indicate clearly on such printed matter which of several items is being submitted for approval.
- B. Sustainable Submittals: For products requiring sustainable attributes as described in 018113 or other related sections; include recycled content percentage (both pre-consumer and post-consumer), proof of relevant indoor air quality certifications as required by MA CHPS, and proof of FSC certification when applicable.
- C. If catalog cuts of standard manufactured items show different types, options, finishes, performance requirements, or other variations, those features that the Contractor proposes to furnish shall be clearly circled or otherwise indicated, and all irrelevant diagrams, notes, or other information deleted or canceled.

1. If any variations from the catalog description are proposed or required, such variations shall be clearly noted on the cut by the Contractor.
2. Wiring diagrams shall be produced to address specific project requirements. Catalog cuts of wiring diagrams will not be acceptable.

2.3 SHOP DRAWINGS

- A. The Contractor shall prepare shop drawings showing such features as required by the Technical Specifications Sections, to demonstrate an understanding of the particular conditions unique to this Project.
 1. Prepare shop drawings at a scale of at least twice the scale of contract drawings showing the same work.
 2. Reproduction of Contract Documents in any form will not be accepted for use as Shop Drawings, unless specifically allowed in writing by the Architect for a particular portion of the Work.
 3. Refer to Section 011400 –WORK RESTRICTIONS for permissible use of electronic documents for the purpose of preparation of shop drawings. Use of Project Electronic Files for shop drawing preparation will be subject to the requirements specified in that Section.
- B. Shop Drawings related to various units comprising a proposed assembly shall be submitted simultaneously so that such units may be checked individually and as an assembly.
- C. Shop Drawing Distribution:
 1. Shop Drawings (one hard copy and one digital copy) shall be submitted through the Contractor directly to the applicable consultant, the Architect, and Clerk.
 2. Drawings submitted directly from Subcontractors, manufacturers or vendors, or directly to the Architect's consultants, will be returned to the Contractor without action.
 3. The Architect will forward copies of submittals to the Clerk of the Works when so requested for their use. However, it is the responsibility of only the Architect and their Consultants to review and respond to submittals.
- D. Each drawing and print shall have a clear space approximately 80 square inches as an additional border on the right or bottom for stamps and Architect's comments.
- E. Shop Drawings shall clearly indicate all details, sectional views, arrangements, working and erection dimensions, kinds and quality of materials and their finishes, and other information necessary for proper checking and for fabrication and installation of the items, and shall include all information required for making connections to other work and/or adjacent materials.
- F. If any information on previously submitted Shop Drawings, aside from notations made by the Architect is revised in any way, such revision shall be circled or otherwise graphically brought to the Architect's attention. If approved Drawings are subsequently revised, they shall be re-submitted to the Architect with all revisions clearly marked for the Architect's attention. Whenever drawings are revised, the latest revisions shall be circled or otherwise indicated to distinguish them clearly from all previous revisions (and from the information on the original drawing).

2.4 SAMPLES

- A. Submit samples as required under the various Sections of the Specifications. Each sample shall be accompanied by a transmittal and cover sheet as required for all submittals. Refer to Submittal Review Transmittal cover sheet attached at the end of this section.
- B. Before submitting samples, consult with Architect to determine whether samples are to be submitted to Architect's office, field, or other location.
- C. Samples shall be submitted in triplicate, with a fourth sample to be submitted to the Clerk for Owner review, unless otherwise specified or directed by the Architect.
- D. Samples may be submitted to Architect directly from manufacturers, vendors, suppliers, Subcontractors, or others, but a separate transmittal letter shall be submitted through the Contractor in each such case.
- E. Approved samples of major or expensive items or assemblies, if in good condition and meeting all requirements of the Contract, may be properly marked for identification and used in the Work, provided that all shipping and handling charges are paid by the Contractor.
- F. Each sample shall have a label indicating the material represented, its place of origin, and the names of the producer, the Architect, the Contractor, the Subcontractor and the building or Work for which the material is intended. Samples shall be marked to indicate the Drawing numbers or Specification Paragraph requiring the materials represented.
- G. Approval of samples for color, texture, and other aesthetic qualities shall not be construed as approval of other characteristics.
- H. Approved samples, unless specifically stated by the Contractor as slated for incorporation in the Work, will be kept on file (and accessible for inspection) by the Architect until Final Acceptance of the Project. Any sample not reclaimed by the Contractor within thirty (30) days after Substantial Completion of the Project will be considered unclaimed material, and may be disposed of by the Architect.

2.5 COLORS AND FINISHES

- A. The Architect will prepare a master color schedule indicating the required color, finish, pattern, material, texture, and other pertinent information in connection with interior and exterior finishes.
- B. Color chips shall be submitted for all items having color unless otherwise directed or approved by the Architect. Upon the expiration of such 45-day period, the Architect will proceed with color selection and preparation of final color schedule. Refer to 1.4,B hereinabove.
- C. The Architect will select the colors and finishes of a manufacturer within the framework of the Specifications. For each item where the Contractor fails to submit the name of a specific manufacturer within the allotted time, the Contractor shall provide such materials without additional compensation.

2.6 CALCULATIONS

- A. Calculations Based on Performance and Design Criteria: Where professional design services

or certifications by a design professional are specifically required of Contractor by the Contract Documents, submit calculations demonstrating that products and systems comply with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents.
 2. Include list of codes, loads, and other factors used in performing these services

2.7 INFORMATIONAL SUBMITTALS

- A. General: Informational submittals comprise written information that does not require Architect's responsive action. Submit to the Architect two copies, or more if specified, for each informational submittal. The Architect will distribute copies to the Owner for their records. Submit one additional copy to Clerk/OPM.
- B. Informational submittals required for the Work include, but are not limited to, the following:
1. Calculations for Contractor-engineered work, as specified in particular specification sections in Divisions 2 through 50.
 2. Research/evaluation reports and test data as specified in particular specification sections in Divisions 2 through 50.
 3. Certifications and other qualification data, as specified in particular specification sections in Divisions 2 through 50.
 4. Maintenance data, as specified in particular specification sections in Divisions 2 through 50.
 5. Confirmation of contract with printing company as specified in this Section.

2.8 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

- A. Normal Submittals:
1. Submit copy of normal submittals for equipment to be commissioned to Commissioning Agent (CxA).
 2. CxA will review and approve normal submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with Architect's and Construction Manager's review.
 3. Provide copy of the Design Team's review comments to the CxA.
 4. Repeat this process for any resubmissions.
- B. Data for Commissioning:
- The following information shall be included in all submittals of commissioned equipment and systems.

1. Detailed manufacturer's installation and start-up procedures.
 2. Operating, troubleshooting, and maintenance procedures.
 3. Fan and pump curves.
 4. Full warranty information, with responsibilities of Owner to keep warranty in force clearly defined.
 5. Installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms to be used by factory or field technicians.
- C. CxA will request specific information needed about each piece of commissioned equipment or system. Information requested includes, but is not limited to:
1. Full details of Owner-contracted tests, if any.
 2. Full factory testing reports, if any.
- D. CxA may request additional documentation necessary for commissioning process. Requests by CxA may precede, be concurrent with, or follow normal submittals. In addition to requirements as specified hereinabove, additional documentation includes, but is not limited to: training agendas, tab report, and o&m manuals.
- E. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by CxA's review.

PART 3 - EXECUTION

3.1 CONTRACTOR ACTION ON SUBMITTALS

- A. Should the Architect in checking shop drawings or other submittals make changes which the Contractor deems will increase the Contract Price, the Contractor shall so inform the Architect and OPM in writing within fourteen (14) calendar days following receipt of the checked submittals and prior to starting fabrication of the item or items. Failing this, the Contractor shall be deemed to have waived all claims for extra compensation for the work involved.
- B. Notes or other information on submittals that are contrary to provisions of the Contract Documents shall be deemed to be addressed to the applicable Contractor, Subcontractor, material supplier or other parties involved, and shall have no force or effect with respect to this Contract, even though the Shop Drawing or Sample involved is approved by the Architect. In particular the terms "By Others", "N.I.C." or words of similar meaning and import on submissions shall not be deemed to imply that the referenced items are to be omitted from this Contract.
- C. The Contractor shall obtain and distribute copies of approved Shop Drawings and other Submittals to his subcontractors and material suppliers needing such information, at no additional cost to the Owner.
- D. The Contractor shall keep on the site, in good order, a complete up-to-date set of all approved Shop Drawings and other Submittals.
- E. Contractor shall assume full liability for delay attributed to insufficient time for delivery and/or installation of material or performance of the Work when approval of pertinent Shop Drawings is withheld due to failure of the Contractor to submit, revise, or resubmit Shop Drawings in adequate time to allow the Architect reasonable time, not to exceed twenty-one (21) calendar days for normal checking and processing of each submission and resubmission. The Archi-

tect will not be limited to twenty-one (21) calendar days when the Submittal Schedule has not been submitted or is not current.

3.2 ARCHITECT ACTION ON SUBMITTALS

A. Product Data and Shop Drawings: After reviewing product data submittals, the Architect will mark each submittal with one of the following responses:

1. The Architect will annotate all submittals digitally, applying a stamp including the following information: "Reviewed as required by the Construction Contract Documents and approved, but only for conformance to the design concept of the Work, and subject to further limitations and requirements contained in the Contract Documents."
2. "Rejected". A digital copy of Rejected submittals will be uploaded into the CA Database. Rejected submittals shall be resubmitted in the same manner until approval is obtained.
3. The stamp will also contain notes indicating possible actions, namely; "rejected"; "revise and resubmit"; and "furnish as corrected". Architect will check one of the actions.
4. Corrections or comments made on the submittals during this review shall not relieve Contractor from compliance with requirements of the Contract Drawings and Specifications. This check is only for review of general conformance with the design concept of and general conformance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.
5. For all Submittals, the Contractor will have prints made from the annotated digital submittals at the Contractor's expense. Such prints shall be used for record purposes and for comparison with subsequent resubmissions. One will be retained by the Architect, one furnished to the applicable consultants. Such procedures shall be followed until the Shop Drawing is marked "Furnish as Corrected", or "Reviewed as required by the Construction Contract Documents and approved, but only for conformance to the design concept of the work, and subject to further limitations and requirements contained in the Contract Documents."
6. Submittals marked "Furnish as Corrected" shall be treated in the same manner as Drawings marked "Reviewed as required by the Construction Contract Documents...and requirements contained in the Contract Documents." The Architect's comments shall be considered part of the original Drawings. Should the Contractor disagree with such comments, he shall so notify the Architect in writing within fourteen (14) days after receipt of such Drawings and before commencing work on the items in question. Failing this, the Contractor shall be deemed to have accepted full responsibility for implementing such comments at no additional cost to the Owner.
7. For documents with the comment "Reviewed as required by the Construction Contract Documents..." or "Furnish as Corrected", the Contractor will have made at the Contractor's expense, four (4) prints of the corrected original for the Architect's and Owner's use.

B. Informational Submittals: Architect will review each informational submittal and will review it for general compliance with submittal requirements

1. Architect will process and digitally distribute each informational submittal as for other submittals.
2. Compliant informational submittals will be marked "Reviewed" and a stamped digital copy will be distributed to Owner's Project Manager, Clerk of the Works and Contractor.
3. Informational submittals that do not comply with submittal requirements specified herein and in the section whose work they cover will be returned "rejected". Re-submittal will be

required.

- C. Repeated Re-submittals: The Architect will review the initial submittal for each product, and one re-submittal if revisions are required.
 - 1. If the first re-submittal is rejected or requires further revision, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform review of an extensive number of repeated submittals, until a submittal for that product is accepted by the Architect with no need for further revision.
 - 2. Refer to Section 011400 –WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.

3.3 SUBSTITUTIONS/ OR EQUALS

- A. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - 1. Substitution is requested by completing a copy of Form 013301 – SUBSTITUTION / OR EQUAL REQUEST FORM, attached to the end of this Section.
 - 2. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 3. Requested substitution/ or equal does not require extensive revisions to the Contract Documents.
 - 4. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 5. Substitution request is fully documented and properly submitted.
 - 6. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 7. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 8. Requested substitution is compatible with other portions of the Work.
 - 9. Requested substitution has been coordinated with other portions of the Work.
 - 10. Requested substitution provides specified warranty.
 - 11. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 calendar days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 21 calendar days of receipt of request, or 7 calendar days of receipt of additional information or documentation, whichever is later.
 - 1. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.
- C. Review of Substitution / Or Equal Requests: The Architect will review Substitution Requests that are submitted in accordance with the requirements of this section, and are shown to be of benefit to the Project.

1. If a request for substitution is incomplete, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional review, until the substitution has been either accepted with no need for further revision, or rejected.
 2. If a request for substitution is shown to be of benefit to the Contractor only and not to the Project, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform review, redesign or coordination due to such substitution.
 3. Refer to Section 011400 –WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible to the Owner for costs for Additional Services of the Architect.
- D. Form of Acceptance of Substitution: Change Order

END OF SECTION

Attachment:

Form 013301 – SUBSTITUTION REQUEST FORM

Form 013302 – SUBMITTAL TRANSMITTAL FORM

FORM 013301
SUBSTITUTION / OR EQUAL REQUEST FORM

Project: Concord Carlisle High School

To: omr architects, inc.

We hereby submit for your consideration the following product as a substitution for the item specified for the above referenced project:

Drawing Number: _____ Drawing Title: _____

Specification Section: _____ Section Title: _____

Paragraph: _____ Specified Item: _____

Proposed Substitution /Or Equal: _____

Attach complete information on changes to Drawings and Specifications, including related work on other Drawings and under other Sections of the Specifications necessary for the proper installation of the proposed substitution, including proper coordination and finishing.

Submit with request complete Product Data, samples and other data necessary to substantiate that the proposed item is equal to or exceeds the specified item in all respects. Include a comparison chart showing material features and properties of the specified item and the proposed substitute, paying particular attention to requirements specifically mentioned in the Specifications or shown on the Drawings, and guarantee/warranty information. Clearly mark manufacturer's literature to indicate equality in performance. In the case of operating equipment or systems, provide information as to servicing and maintenance requirements, and anticipated service life in the indicated application.

Fill in the blanks below (attach additional sheets as necessary):

A. Does the substitute affect dimensions shown on the Drawings: Yes No
(if yes, clearly indicate changes on enclosures)

B. Will the undersigned pay for changes to the building design, including architectural/engineering detailing costs caused by the requested substitution: Yes No
(if no, please explain)

C. What effect does the substitution have on other Contracts or other trades? _____

D. What effect does the substitution have on construction schedule? _____

E. Manufacturer's warranties of the specified and proposed items are: Same Different

Explain: _____

F. Itemized comparison of specified item with proposed substitute is attached.

G. This substitution will amount to a credit or extra cost to the Owner of: _____
_____ Dollars

(\$_____).

H. Does the substitution reduce or alter sustainable attributes (pre-consumer recycled content, post consumer recycled content, indoor air quality certification, FSC certification)? Yes No

Explain:

Notes:

Submission of this form by the Contractor will not require the Owner to accept the proposed substitution unless the substituted product or system meets the requirements of Massachusetts General Law, Chapter 30, Section 39M and is acceptable to the Architect.

The Owner's acceptance of any substitution will not change the Contract Price, unless the Owner, Contractor and any other required parties execute a Change Order in accordance with the terms and provisions of the Contract Documents.

Refer to Section 013300 – SUBMITTAL PROCEDURES, for additional requirements for the submittal and processing of substitution requests.

Submitted By: _____
(signature)

Title: _____

Firm: _____

END OF FORM

SECTION 014000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for
 - 1. Quality assurance
 - 2. Quality control
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Program of Structural Tests and Inspections: In addition to tests and inspections as indicated herein, perform required testing and inspections in accordance with the "Program of Structural Tests and Inspections", immediately following this section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after

execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.
- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the min-

imum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Testing and Inspection Log: Submit updated copy of log each month with the Application for Payment.
- C. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient

production capacity to produce required units.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using ma-

terials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Coordinate the work of multiple subcontractors as needed to build complete mockups of multi-component systems.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 5. Perform field tests on mock-up panels to show compliance with requirements as specified in individual sections. At a minimum, perform air leakage and water infiltration testing.
 6. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 8. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 50.

1.7 QUALITY CONTROL – OWNER RESPONSIBILITIES

- A. General: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Testing, inspections and commissioning performed by the Owner or the Owner's agents in no way reduce the responsibility of the Contractor to meet performance requirements, descriptive criteria and all other requirements of the specifications, nor do these activities on the part of the Owner relieve the Contractor from performing Quality Assurance and Quality Control measures specified.
- B. Tests and Inspections: The Owner reserves the right to employ consultants and testing agencies to test the performance of the Work and to inspect the Work for conformance with the Contract Documents.
1. Notice for Testing: The Contractor shall give the Owner a minimum 24-hour notice when installations that require testing are ready for testing or inspection.
 - a. Earlier notice shall be given where specified in a given technical section of the Specifications.
 - b. If the Owner's testing agency arrives at the site to test the performance of the work, and determines that the installation is not ready for testing or inspections, then the Contractor shall be responsible for the costs of the testing agency's site visit
 2. Availability of Test Results: The results of such tests and inspections will be made available to the Architect and Contractor.
 3. Correction of Work:
 - a. Where results demonstrate deficiencies in the Work, the Contractor shall take all actions necessary to correct the Work in a timely manner at their own expense.
 - b. When the Contractor considers the Work to be corrected, further tests and inspections will be performed by the Owner's consultants and testing agencies at the Contractor's expense.

- C. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
- D. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

1.8 QUALITY CONTROL – CONTRACTOR RESPONSIBILITIES

- A. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- E. Associated Services: Cooperate with agencies performing required tests, inspections, and

similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. Schedule times for tests, inspections, obtaining samples, and similar activities.
- G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specifica-

tion Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

2. Comply with the Contract Document requirements for Section 017329 – CUTTING AND PATCHING.

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.3 ATTACHMENTS

- A. Program of Structural Tests and Inspections.

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following:
 - 1. Temporary facilities and services.
 - 2. Temporary water.
 - 3. Weather protection
 - 4. Temporary heating and ventilating
 - 5. Temporary humidity control.
 - 6. Temporary electricity and lighting
 - 7. Temporary telephone
 - 8. Temporary sanitary facilities
 - 9. Temporary fire protection
 - 10. Temporary stairs and ladders
 - 11. Temporary hoists and chutes
 - 12. Staging and scaffolding
 - 13. Temporary use of elevators
 - 14. Temporary enclosures
 - 15. Protection of work, property and the public
 - 16. Security of the work
 - 17. Rodent control.
 - 18. Water control
 - 19. Snow and ice control
 - 20. Construction fence
 - 21. Project signs
 - 22. Temporary offices

1.3 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Informational Submittals: Submit the following plans for temporary protection and facilities as

specified in this Section:

1. Weather protection plan
2. Temporary humidity control procedures
3. Temporary heating plan
4. Temporary fire protection plan.

1.4 TEMPORARY FACILITIES AND SERVICES

- A. Contractor shall be responsible for arranging and providing temporary facilities and general services at the site as specified herein and as otherwise required for proper and expeditious execution of work. Except as otherwise specified, the Contractor shall pay costs for all temporary facilities and general services until Final Acceptance of the Work and shall remove same at completion of the Work.
- B. All such services and facilities shall comply with applicable Federal, State and local regulations.
- C. Contractor shall make all connections to existing services and sources of supply, shall provide all necessary installations, labor, materials, and equipment, in a manner subject to the approval of the Architect and the Owner, shall remove temporary installations and conditions when no longer required, and shall restore the services and sources of supply to proper operating condition as approved by the Architect.
- D. Discontinuance of any temporary service prior to the completion of any portions of the Work shall not render the Owner liable for any additional cost resulting therefrom.
- E. Should a change in location of any temporary equipment be necessary in order for the Work to progress properly, Contractor shall remove and relocate such equipment as required without additional cost to the Owner.
- F. Temporary Parking Lot: Construct temporary parking lot shown on approved Logistics Plan for temporary use of Owner and Contractor during construction. Demolish temporary parking lot and restore area for permanent use as shown on Drawings.

1.5 TEMPORARY WATER

- A. Furnish potable water for construction purposes for trades at a point within 10 feet of building being constructed. Make arrangements and pay charges for water service installation, maintenance, and removal thereof, and pay costs of water for all trades.
- B. After installation, permanent water supply and distribution system may be used as source of water for construction purposes, provided that the Contractor pays applicable municipal water costs and assumes responsibility for damage to water distribution system and pays costs of restoration of system where so damaged.
- C. Temporary pipe lines and connections from the permanent service line, either outside or within the building, necessary for the use of the Contractor and his Subcontractors shall be installed, protected and maintained at the expense of the Contractor.
- D. In addition to temporary lines and connections, the Contractor, if required by the Owner, shall at the Contractor's expense install a temporary meter in a frostproof box in such location and

in such manner as may be approved by the Architect.

- E. Provide an adequate supply of drinking water from approved sources of acceptable quality, satisfactorily cooled, for Contractor's employees and those of his Subcontractors. Where required, furnish drinking water in suitable containers and provide single-service cups for use of employees. Drinking water dispensers shall be conveniently located in building where work is in progress.
- F. At completion of construction work, temporary water service equipment and piping shall be removed by Contractor.

1.6 WEATHER PROTECTION

- A. It is the intent of these Specifications to require the Contractor to provide temporary enclosures and heat to permit construction work to be carried on during the months of October through April and in compliance with Massachusetts General Laws. These Specifications are not to be construed as requiring enclosures or heat for operations that are economically infeasible to protect in the judgment of the Architect. Included in this category, without limitation, are such items as site work, excavation, pile driving, steel erection, erection of certain exterior wall panels, roofing, and similar operations.
- B. "Weather Protection" shall mean the temporary protection of that work adversely affected by moisture, wind and cold, by covering, enclosing and/or heating. This protection shall provide adequate working areas during the months of November through March as determined by the Architect and consistent with the approved construction schedule to permit the continuous progress of all work necessary to maintain an orderly and efficient sequence of construction operations. The Contractor shall furnish and install all "weather protection" material and be responsible for all costs, including heating required to maintain temperature of 40 degrees F. at the working surface. This provision does not supersede any specific requirements for methods of construction, curing of materials or to performance obligations of the Contractor.
- C. Within 30 calendar days after award of Contract, the Contractor shall submit in writing to the Architect for approval, three (3) copies of his proposed methods for weather protection.
- D. Installation of weather protection shall comply with all safety regulations including provisions for adequate ventilation and fire protection.
- E. Determination of extent of work to be performed during winter months shall be by the Contractor, with Owner's approval provided that work shall proceed at such a rate as to insure Substantial Completion on or before the stipulated date in accordance with the Progress Schedule.
- F. Be responsible for providing protection against damage to materials and work installed in freezing weather by providing special heat and coverings to prevent damage by the elements, in a manner approved by the Architect. Protect the ground surfaces under footings, under pipelines, under masonry, under concrete and other work subject to damage, against freezing or ice formation. If low temperature makes it impossible to continue operations safely in spite of cold weather precautions, cease work, and so notify the Architect.

1.7 TEMPORARY HEATING AND VENTILATING

- A. Within thirty (30) calendar days after commencement of work under this Contract, the Con-

tractor shall submit in writing to the Architect for approval, three (3) copies of his method and time schedule for heating during construction, which shall concur with his general Progress Schedule.

- B. Temporary weather-tight enclosures and temporary heating shall be provided by the Contractor as required during construction to make the building weather-tight and to protect work from freezing and frost damage. All costs of closing in buildings, and all costs of temporary heat shall be paid for by the Contractor until Substantial Completion.
- C. Contractor shall provide for temporary heating and shall pay fuel costs for heating directly to the utility company. Contractor may not tie into the Owner's permanent heating and ventilating system. In areas of building where work is being conducted, temperature shall be continuously maintained as specified in Sections of Specifications but not less than 50 degrees F. nor more than 75 degrees F.
- D. Furnish and install one accurate recording Fahrenheit thermometer at a place designated by the Owner, located as directed by the Owner in order to determine that the specified temperatures are being maintained.
- E. When work has progressed sufficiently for installation of glazing, Contractor may, if approved by Architect, use glazed windows in place of temporary enclosures. Permanent windows shall be protected against damage from mortar, cement, plaster, and other material, and from damage by other trades; and upon completion of work shall be thoroughly cleaned, damaged component parts including glass shall be satisfactorily repaired or replaced, and windows left in perfect condition, prior to Substantial Completion.
- F. Where building systems are inoperable, temporary heating shall be by smokeless portable unit heaters, steam generators or forced warm air heaters (UL, Factory Mutual, Fire Marshall approved), located outside building or vented to the outside. Contractor shall pay for fuel, maintenance and attendance required in connection with temporary heat. Surfaces, interior or exterior, damaged by use of these space heaters shall be replaced by new materials or be refinished to the satisfaction of the Architect without additional cost to the Owner. Use of oil burning "salamanders" is forbidden and nonvented open flame heaters will not be permitted inside after the building is closed in. Do not use propane-fueled heaters inside building or near stockpiles of combustible materials.
- G. When new heating system, or suitable portion thereof, is in operating condition, such system may be used for temporary heating, provided that the Contractor obtains written approval of Architect and Owner.
- H. Use of permanent air handling facilities for construction heating purposes will not be permitted.
- I. Make periodic inspections of the equipment and controls to insure proper operation of the system, as conditions require, and report any failings. Installation and operation of weather protection and heating devices shall comply with all safety regulations including provisions for adequate ventilation and fire protection.
- J. Upon conclusion of temporary heating period, Contractor shall remove temporary piping, temporary radiators, other equipment and pay costs in connection with repairing damaged caused by installation or removal of temporary heating equipment and shall thoroughly clean and recondition those parts of permanent heating system used for temporary service.
- K. Provide adequate ventilation as required to keep temperature of building within 10 degrees of

ambient outdoor temperature when such. ambient temperature exceeds 70 degrees F., and to prevent accumulation of excess moisture in building. Refer to Section for Indoor Air Quality Requirements, for additional requirements for ventilation during construction

1.8 TEMPORARY HUMIDITY CONTROL

- A. Humidity Control of Enclosed Building: The contractor shall install the following equipment to monitor and regulate relative humidity as required for the installation of all interior products. Humidity control equipment shall include, but not be limited to, the following:
 - 1. Hygrometer: Provide one device to measure temperature and relative humidity in each construction area.
 - 2. Dehumidifier, as required to maintain humidity of enclosed areas below 70%:
 - 3. Fans: As required to eliminate significant variation in humidity levels within enclosed spaces.
- B. Schedule for Humidity Control: Relative humidity shall be maintained within the limits set by manufacturers of all interior materials and equipment. Refer to individual specification sections in Divisions 06 – WOOD, PLASTICS, AND COMPOSITES, 09 - FINISHES, 10 - SPECIALTIES, 11 EQUIPMENT and 12 – FURNISHINGS for additional environmental requirements. No interior construction product shall be installed or applied prior to enclosure of building and installation of temporary humidity control measures.
- C. Within 30 calendar days after award of Contract, the Contractor shall submit in writing to the Architect for approval, three (3) copies of his proposed methods for humidity control.

1.9 TEMPORARY ELECTRICITY AND LIGHTING

- A. Make arrangements as required with local electric company for temporary electric service, pay expenses in connection with installation, operation, and removal thereof, and pay cost of energy consumed by all trades until Substantial Completion of the building. Contractor shall make payments for electrical service directly to the electric company.
- B. Take care not to overload equipment and lines. Provide and relocate temporary electric meters as required.
- C. Power: Provide power distribution as required throughout new structure 120/208 volt, 3 phase, 60 cycle AC. Termination of power distribution shall be at one location in each major section of building, approximately at center. Termination shall be provided complete with circuit breakers, disconnect switches and other electrical devices as required to protect power supply system. Submit plan showing electrical distribution locations for Architect's approval.
- D. Lighting: Temporary lighting system shall be furnished, installed and maintained by Contractor as required to satisfy minimum requirements of safety and security. Temporary lighting system shall afford general illumination in building areas and supply not less than one (1) watt per square foot of floor area for illumination in areas of building where work is being performed. Provide adequate outdoor lighting to illuminate staging, stockpiles, trenches, projections, office trailers and other items, to the satisfaction of the Architect, and general illumination throughout adequate for watchmen and emergency personnel.
- E. Safety: All temporary equipment and wiring for power and lighting shall be furnished and installed in conformity with the National Electrical Code and in accordance with local ordin-

ances and requirements of the municipal power authority. All temporary wiring and accessories shall be maintained in a safe manner and utilized so as not to constitute hazard to persons or property and shall be removed after they have served their purposes.

- F. When permanent electrical power and lighting systems are in operating condition, they may be used for temporary power and lighting for construction purposes, provided that Contractor obtains written approval of Architect and Owner. If permanent lighting fixtures are used in temporary light, provide new lamps for fixtures used for temporary light before Substantial Completion of the Work.
- G. At completion of construction work, or at such time as Contractor makes use of permanent electrical installation, temporary wiring, lighting and other temporary electrical equipment and devices shall be removed by Contractor.

1.10 TEMPORARY TELEPHONE

- A. Arrange with local telephone company to provide direct line telephone service at the construction site. Provide:
 - 1. One direct line instrument in Field Office for the Contractor with electronic answering machine.
 - 2. Two direct line instruments in Field Office of the Clerk of the Works equipped with electronic answering machine; plus one direct line for facsimile machine in office. Turn over keys to Clerk of the Works and Architect.
 - 3. Two (2) Nextel Motorola i530 Mobile Phones with Nextel National 500 Plans for use by the Clerk of the Works.
 - 4. High Speed internet access and router via DSL, Broadband, Cable, or equal with unlimited internet access to the Field offices of the Contractor and Clerk of the Works.
 - 5. Other instruments at the option of the Contractor, or as required by regulations.
 - 6. Each Subcontractor shall make his own arrangements for telephone service.
- B. Pay for installation and removal of temporary telephones and facsimile lines and for all calls and fixed charges in connection therewith; including unlimited long-distance calling.
- C. Temporary telephone services shall be maintained until Substantial Completion of the Work.

1.11 TEMPORARY SANITARY FACILITIES

- A. Contractor shall provide an adequate number of toilet facilities with chemical type toilets and temporary lighting rented from and serviced by an approved company, as necessary for all persons engaged on the Work. Provide separate facilities for male and female workers.
- B. Toilets shall be erected in location approved by the Architect, shall be maintained by the Contractor in a clean and orderly condition in compliance with all local and State health requirements, and shall be removed at Substantial Completion of the Work.
- C. Permanent toilet facilities shall not be used by the Contractor, Subcontractors or any persons engaged by them during the course of work under this Contract.
- D. If Sanitary Facilities are not activated in the OPM/Owner Trailer, a separate/lockable toilet will be maintained in accordance with this specification in close proximity to the OPM trailer for exclusive use by the Owner/OPM/Architect until such time as trailer facility is operative or

Substantial Completion.

1.12 TEMPORARY FIRE PROTECTION

- A. Provide and maintain adequate temporary fire protection in the form of barrels of water with buckets, fire bucket tanks, fire extinguishers, or other effective means of extinguishing fire, ready for instant use, distributed around the Project and in and about temporary inflammable structures during construction of the Work.
- B. Within 30 calendar days after award of Contract, the Contractor shall submit in writing to the Architect, three (3) copies of his proposed methods for fire protection that have been reviewed and approved by the local Fire Department. Post a copy of the approved fire protection plan in the Field Office for reference.
- C. Gasoline and other flammable liquids shall be stored in and dispensed from UL listed safety containers in conformance with National Board of Fire Underwriter's recommendations. Storage shall not be within building.
- D. Make arrangements for periodic inspection by local fire protection authorities and insurance underwriter's inspectors. Cooperate with said authorities and promptly carry out their recommendations.
- E. Tarpaulins used during construction work shall be made of material that is resistant to fire, water, and weather. Tarpaulins shall have UL approval and comply with FS-CCC-D-746.
- F. Torch-cutting and welding operations performed by Subcontractors shall have approval of Contractor before such work is started and chemical extinguisher shall be available within sight and not over ten (10) feet from location where such work is in progress.
- G. Do not light fires in or about premises.

1.13 TEMPORARY STAIRS AND LADDERS

- A. Each trade shall provide its own ladders where such ladders do not exceed a height of eight feet. Where ladders over eight feet, or stairs, steps or ramps of any height are required, the Contractor shall provide the entire installation, including the first eight feet.
- B. All such apparatus, equipment and construction shall meet all requirements of Federal, State and local laws applicable thereto.
- C. As soon as permanent stairs are erected, Contractor shall provide temporary protective treads, handrails, and shaft protection at stair locations.

1.14 TEMPORARY HOISTS AND CHUTES

- A. Each trade shall provide its own hoists, including associated rigging, conveyance apparatus and chutes, where the maximum elevation of such hoists does not exceed a height of eight feet. Where hoists with elevations over eight feet are required, the Contractor shall provide the entire installation, including the first eight feet, and also including associated rigging, conveyance apparatus and chutes.

- B. Construction, maintenance and operation of material hoists shall conform to applicable requirements of the "Standard Safety Code for Building Construction", ANSI; to AGC "Manual" requirements and to State and local regulations.
- C. Temporary ladders, ramps, runways, chutes, derricks, stairs, and similar items required for proper execution of Contractor's work and that of his Subcontractors shall be properly maintained. Use of such facilities by other contractors, subcontractors and trades shall be permitted as required by construction schedule. Hoists and chutes shall be so constructed as to prevent damage, staining and marring of permanent work.
- D. No materials, rubbish or debris, shall be permitted to drop free, but shall be removed by the use of material hoist and/or fully enclosed rubbish chute.
- E. Provide openings in slabs, roofs, walls and partitions, where required, for moving in large pieces of equipment. Close and restore openings and finish them after equipment is in place. Structural modification, if required, shall be subject to prior written approval by the Architect.

1.15 STAGING AND SCAFFOLDING

- A. Responsibility for Staging:
 - 1. Staging eight feet or less in height: Each trade shall provide staging and scaffolding required for its work, where such staging and scaffolding does not exceed a height of eight feet.
 - 2. Staging greater than eight feet in height: Where staging or scaffolding over eight feet high is required, the General Contractor shall provide the entire installation, including the first eight feet.
 - 3. The General Contractor shall coordinate the use of staging and scaffolding as required to permit trades to perform the Work in a timely manner.
- B. Construction Requirements for Staging: The General Contractor is responsible for safety of staging and scaffolding, including but not limited to the following requirements:
 - 1. Staging shall be of approved design, erected and removed by experienced stage builders, and shall comply with all applicable OSHA standards.
 - 2. Provide accident prevention devices required by State and local laws.

1.16 TEMPORARY USE OF ELEVATORS

- A. Make arrangements with Elevator Subcontractor for temporary use of elevators, if required, during construction period, and for normal use by all trades and Subcontractors.
- B. Make arrangements for provision of temporary cab enclosures, cars, car switches, gate contacts, power, signaling devices, temporary hoistway openings, protection of permanent hoistway entrances and other installed finished work, and pay for all such other items as are necessary to permit temporary operation in accordance with local, State and national codes.
- C. Arrange with Elevator Subcontractor for all necessary maintenance of elevators during period of temporary operation and for restoration of elevators to their original, perfect condition with guarantees as specified. All costs in connection with temporary operation of elevators shall be paid by the Contractor.
- D. Do not abuse, overload or otherwise damage elevators in temporary use for construction purposes.

- E. Elevator will be made available to the Owner for use during installation of FF&E, IT and Owner materials at no cost to the Owner.

1.17 TEMPORARY ENCLOSURES

- A. Provide temporary weathertight enclosure of exterior walls as necessary to provide acceptable working conditions, provide weather protection for interior materials, allow for effective temporary heating, and to prevent entry of unauthorized persons.
- B. Provide temporary exterior doors with self-closing hardware and padlocks. Permanent door enclosures shall not be used as temporary enclosures. Other enclosures shall be removable as necessary for work and for handling of materials.
- C. Refer to Section INDOOR AIR QUALITY REQUIREMENTS, for requirements for temporary interior partitions to enclose portions of the work where required for protection of indoor air quality.
- D. Relocate temporary enclosures as required by progress of construction, by operations of the building, or work requirements, and to accommodate legitimate requirements of Owner and Subcontractors employed at the site.
- E. Completely remove temporary materials, equipment and services when enclosure needs can be met by use of permanent construction and at completion of the Project.

1.18 PROTECTION OF WORK, PROPERTY AND THE PUBLIC

- A. Furnish, erect, and maintain, until such time as removal is approved by the Architect, temporary fencing and barricades to extent recommended by OSHA and as otherwise required for the protection of life and property during operations under the Contract.
- B. Construct barricades and protective facilities in accordance with local and State regulations. Furnish and install all signs, lights, reflectors, and all such protection facilities as may be required.
- C. Contractor shall save the Owner harmless from all claims arising from the use of public streets, sidewalks, and adjoining premises for construction purposes.
- D. Keep all access roads and walks clear of debris, materials, construction plant and equipment during building operation. Repair streets, drives, curbs, sidewalks, fences, poles and the like where disturbed in building operation and leave them in as good condition after completion of the Work as before operations started.
- E. Protect all planting, landscaping, trees and site improvements to remain.
- F. The Contractor shall be responsible for the maintenance of construction barriers and traffic barriers in order to maintain traffic around the Work with the maximum of safety and practical convenience to such traffic during the life of the Contract, and whether or not work has been suspended temporarily. He shall take all precautions for preventing injuries to persons or damage to property on or about the Work.
- G. Work shall be carried on and barriers erected in such a manner as to provide safe passage at all times for public travel and with least obstruction to traffic. The Contractor shall provide

and maintain at his own expense in a safe and passable condition such temporary bypasses created by the barriers as may be necessary to accommodate both pedestrian and vehicular traffic.

- H. Whenever gale or high winds are forecast, take proper measurements to secure all loose material, equipment or other items that could blow about and be damaged or cause damage to other work. No such loose items shall be left unsecured at end of working day. Particular attention shall be taken with scaffolding and items placed or stored on roofs or within the structure prior to being enclosed.
- I. Remove all snow and ice which may impede work, damage the finishes or materials, be detrimental to workers, or impede trucking, delivery, or moving of materials at the job site, or prevent adequate drainage of the site or adjoining areas.
- J. Be responsible for all breakage of glass from the time construction operations commence in each portion of the Project until each portion of the Project is occupied by the Owner. Unless glass has been broken by the Owner or his representatives, or by other separate prime contractors, the cost of glass replacement shall be borne by Contractor.

1.19 SECURITY OF THE WORK

- A. The Contractor shall be responsible for providing any and all security precautions necessary to insure adequate protection of his and the Owner's interests.
- B. Take all required measures to protect the Work at all times against fire, storm, theft, vandalism and other losses.
- C. The Contractor shall be wholly responsible for patrolling and protecting the work under construction and the materials stored on the site; and shall reimburse the Owner for any losses, damage or injury not compensated by insurance, except those directly caused by the Owner, his agents or his employees.
- D. The Contractor shall rebuild, repair, restore and make good all damage to any portion of the Work occasioned by any of the above causes before completion and written acceptance of the completed Work, and shall bear the expense thereof. No extension of time will be allowed in such cases.
- E. Should the Contractor fail to take prompt action whenever conditions make it necessary, the Owner may make emergency repairs or cause the same to be made, with the stipulation that the costs for such repairs shall be charged against the Contractor and deducted from monies due to him.

1.20 RODENT CONTROL

- A. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents and to perform extermination and control procedures at regular intervals so Project will be free of rodents and their residues at Substantial Completion.
 - 1. Obtain extended warranty for Owner.
 - 2. Perform control operations lawfully, using environmentally safe materials.
 - 3. The Contractor's attention is brought to the fact that the building will be occupied by children. Every effort shall be made to avoid applications of materials that will in any

way compromise their health.

1.21 WATER CONTROL

- A. Take over responsibility for site drainage in work areas upon entering the premises and maintain such drainage during the life of this Contract in a manner approved by the Architect and so as not to adversely affect adjacent areas or abutting property.
- B. During the progress of the Work, provide and maintain all required pumps, suction and discharge lines, and power in sufficient number and capacity to keep all excavations, pits, trenches, foundations, and the entire property area free from accumulation of water from any source whatsoever, at all times, and under any and all circumstances and contingencies that may arise.

1.22 SNOW AND ICE CONTROL

- A. De-icing Materials:
 - 1. General: Comply with state and local regulations.
- B. Snow Storage:
 - 1. General: Comply with state and local regulations.

PART 2 - PRODUCTS

2.1 CONSTRUCTION FENCE

- A. Furnish, install, maintain, and pay for temporary fencing and other protection required for the safety of the Work and of stored materials and equipment. Provide temporary construction fence as required for public safety and protection around entire construction area at the Limit of Work line, as shown on Drawings.
 - 1. Existing Fence: Contractor may use the existing 6'-0" high fence on site, but shall modify it to comply with requirements as specified herein and per the site layout needs. Furthermore, the existing fence lease shall be transferred from the Town to the Contractor.
 - 2. Contact Information for the Temporary Fencing Contractor:

Wood & Wire Fence Company, Inc.
Matt Annicelli- Project Manager
125 Higginson Avenue
Lincoln, RI, 02865
PH: 401 727 0806 X314
Fax: 401 312 0339
- B. Construction fence shall be eight (8) feet high and of chain link construction with 6 gauge wire at the top and the bottom of the fencing material, erected in a substantial manner, straight, plumb and true. Construction fence shall include windscreen fabric from top to bottom for dust control and visual screening.
- C. Gates shall be built into fence at such approved locations as are necessary, well cross-

braced and hung on heavy strap hinges with proper post and hook for double gates. Provide heavy hasps and padlocks for each gate. Provide keys to Owner to facilitate emergency access by Owner's Security Forces and local Police and Fire Department.

- D. All fencing shall be in accordance with local ordinances and shall be removed at such time before Final Acceptance as the Architect directs. Restore site to acceptable condition after removing fence.
- E. Vehicular access to the site, and parking for Contractor's employees' vehicles shall be restricted to the specific areas designated by the Owner.

2.2 PROJECT SIGNS

- A. Provide in a location designated by the Architect one (1) sign, 4 feet by 8 feet in size, with three 4-inch by 4-inch post supports. Sign shall be fabricated from 3/4 inch thick medium density overlaid exterior plywood, edged continuously with 3/4 inch square pine banding. Apply one coat of exterior primer and two coats of exterior gloss enamel to all surfaces of sign and supports.
- B. Sign shall be professionally produced and shall indicate: (1) the name of the Project, (2) the name of the Owner, (3) the name of the Contractor, (4) names and addresses of the Architect and Consulting Engineers, and (5) the phrase "This Project Funded in Part by the Massachusetts School Building Authority". Graphic images and lettering, including type size, style and colors, will be provided by the Architect prior to beginning of construction. Architect will provide layout in electronic disc format or printed copy for sign production.
- C. Provide directional signs as required to properly control construction traffic at site.
- D. No other signs or advertisements will be allowed on building or premises.

2.3 TEMPORARY OFFICES

- A. Provide, maintain, and pay all costs in connection with temporary offices; including but not limited to office furniture, office equipment, and exhaustible office supplies.
- B. In addition to his own requirements, the Contractor shall provide and bear all costs for completely enclosed weathertight structure equal to Williams Scotsman Model MO6012; not less than 60'-0" x 12'-0" in area for use of the Owner's Project Manager, the Architect, and their representatives. The trailer shall have two offices and a conference room, a reasonable amount of natural light, adjustable natural ventilation, and two exterior doors with dead bolt locks accessible and keyed from the outside. In addition include the following equipment:
 - 1. One private toilet facility with running water within the structure.
 - 2. Heat during cold weather below 55 degrees F.
 - 3. One layout table, approximately 36" x 84" with one drafting stool and two drafting lamps with bulbs.
 - 4. Three desks (30x60 standard double pedestal) and three desk chairs (swivel type with arms) in separate offices. One desk and one desk chair in the main area.
 - 5. Twelve straight back folding chairs.
 - 6. Six metal file cabinets (4 drawers each) with locks.
 - 7. One plan rack to accommodate at least 6 sets of drawings.
 - 8. Three desk-type telephones.

9. One electronic telephone answering machine.
 10. One coat rack, two wastepaper baskets, one 30"x40" wall-mounted markerboard, and one 30"x40" wall-mounted tackboard.
 11. One exterior high quality mercury thermometer.
 12. Air conditioning during weather above 75 degrees F.
 13. Two conference tables, 36" x 72" and 8'-0" of 12" deep shelving.
 14. Sufficient number of electric lights (50 fc at desk level over entire area) and outlets.
 15. One Brother MFC•5895cw Printer Copier Scanner, or equal as approved by OPM. Provide letter, legal and 11 x 17 paper supply and required printer ink cartridges for the duration of the work.
 16. One facsimile transmitting and receiving machine with dedicated telephone line.
 17. One digital camera equal to USA PowerShot S45 and direct interface data cable.
 18. Supplies: Office supplies, including toners for all equipment, four (4) pairs of boots, four hard hats, and raincoats, one water-cooler with refrigerator, paper cups, and weekly bottle replacement for the duration of the project.
 19. One industrial quality wall-mounted first aid kit sized and supplied for 10 people.
 20. One automatic coffee machine equal to 2011•02 Keurig B140 Brewing System.
 21. One new computer equal to or better than a Dell Dimension 4550 Series Pentium 4 processor at 2.66 GHz w/ 533 MHz front side bus/512K L2 Cache, 333MHz DDR SDRAM, 512mb RAM. Include a Dell quietkey keyboard, a new 17 in E171 FPb Flat Panel Display, a Video Card equal to or better than 64mb DDR NVIDIA GeForce MX Graphics Card with TV-Out, a Hard Drive with a minimum of 60 GB Ultra ATA/100 7200 RPM, a 3.5 floppy disk drive, an operating system equal to MS Windows XP Professional, a Logitech Optical USB or equal mouse, a Network to include Integrated Intel Pro 10/100 Ethernet or equal and related cord, a 56K PCI Data/Fax Modem and related cord, a CD/DVD Drive equal to 48x/24x/40x Max CD-RW/DVD Combo Drive, a Sound Card equal to Sound Blaster Live 5.1 Digital Sound Card, a Speaker equal to Harmon Kardon HK-206, a zip drive equal to 250 mb lomega ZIP Built-in Drive, and Software equal to MS Office XP Small Business. All items, including related power cords, adapters, surge suppressors, and other misc items necessary to operate the equipment are to be installed and made operational for use by the Clerk of Works.
- C. Heat and Air Conditioning shall be maintained to provide an indoor air temperature of 76 degrees F at 72 inches above the floor and throughout the space during the cooling season and 70 degrees F at 30 inches above the floor during the heating season.
- D. Electrical Convenience Power: Provide convenience outlets for at least 2400 watts and at least 2 convenience circuits independent of the lighting, equipment power, and heating needs.
- E. Offices shall be located in location approved by the Architect, shall be maintained by the Contractor in a clean and orderly condition, and shall be removed at Substantial Completion. The Contractor shall provide a cleaning service in each office at regular intervals (at least weekly).
- F. Provide routine emergency service for office equipment specified and reasonable quantities of expendable supplies as required for job related use. When the sitework and building has been completed to the extent that removal of the temporary structures is required, the Contractor shall provide a fully organized and connected temporary office spaces within the building located in and area approved by the Architect.
- G. All office equipment provided under this Section shall be the property of the Contractor and shall be removed at Substantial Completion; except the computer, camera, printer, and associated hardware and software for which the titles and licenses shall be transferred to the Awarding Authority before final acceptance of the Project.

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PART 3 - EXECUTION (NOT USED)]

END OF SECTION

SECTION 017329
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for additional requirements that affect this Section whether or not specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section covers procedural requirements for cutting and patching, including but not limited to the following:
 - 1. Standard requirements for all cutting and patching to be done on the Project, whether by the General Contractor, Filed Sub-Contractors or other subcontractors.
- B. Refer to the following Sections for related work:
 - 1. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for temporary protection, shoring and construction aids.
 - 2. Section 017400 – CLEANING AND WASTE MANAGEMENT, for disposal of demolished materials.
 - 3. Divisions 2 through 12 Sections, for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 4. Section 033000 – CAST-IN-PLACE CONCRETE, for cutting, patching and repair of concrete.
 - 5. Section 042000 – UNIT MASONRY, for cutting and patching of masonry for the work of all trades, unless otherwise provided herein.
 - 6. Section 042000 – UNIT MASONRY, for installation of lintels where required for all penetrations through new masonry.
 - 7. Section 055000 – METAL FABRICATIONS, for furnishing of lintels where required for all penetrations through new masonry.
 - 8. Section 078400 – FIRESTOPPING, for patching fire-rated construction.
 - 9. Division 9 – FINISHES, for all patching of new construction, except for masonry and concrete.
 - 10. Section 092900 – GYPSUM BOARD, for cutting and patching gypsum wallboard construction.
 - 11. Section 099000 – PAINTING AND COATING, for final preparation of new and patched surfaces as required for application of paint, and for paints and coatings applied to patched surfaces..
 - 12. Division 21,22,23 – MECHANICAL and Division 26 – ELECTRICAL, for coring and drilling for all items to be installed by mechanical and electrical trades, except as otherwise indicated.

13. Division 21,22,23 – MECHANICAL and Division 26 – ELECTRICAL, for items to be installed by mechanical and electrical trades, except as otherwise indicated.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
- C. Coring: Any new penetration cut through existing or new construction using core drill and measuring no more than 6 inches in diameter, or 6 inches by 6 inches. Larger cores are considered under cutting.

1.4 RESPONSIBILITY FOR CUTTING AND PATCHING

- A. General: All cutting and patching shall conform to the requirements of this Section, whether or not the work is to be done by the Contractor, a Filed Subcontractor or other Subcontractor.
 1. Patching shall be performed so as to maintain the integrity of acoustical rating of adjacent construction.
 2. Refer to Section 078400 – FIRESTOPPING, for requirements for maintaining the integrity of fire-rated construction at penetrations.
- B. Coordination: The General Contractor shall be responsible for the following:
 1. Obtain locations and dimensions of penetrations required through walls and floors from trades requiring penetrations.
 2. Coordinate those penetrations with the requirements of other trades.
 3. Forward locations and dimensions of requested penetrations to the trades responsible for performing the cutting and patching work.
- C. Modifications with Structural Implications:
 1. Non-masonry construction: Provide new penetrations and other work where modification to existing structural elements is shown on the Drawings.
 2. Masonry construction: Coordinate the work of Subcontractors as required where modification to existing load-bearing masonry is shown on the Drawings.
 3. Do not perform any work that will alter existing structural elements unless it is shown on the Drawings or proposed alterations have been approved in writing by the Architect.
 4. Structural elements include, but are not limited to, the following: Steel beams and columns, structural masonry walls, reinforced concrete slabs.
- D. Coring: All coring shall be performed by the trade requiring the new penetration.
- E. New Penetrations in Masonry Construction:
 1. Exposed masonry and all masonry bearing walls: All cutting and patching shall be performed under Section 042000 – UNIT MASONRY, with lintels furnished under Section 055000 – METAL FABRICATIONS where required.
 2. Concealed portions of non-bearing masonry walls:
 - a. Small penetrations where no lintel will be required shall be provided under Section 042000 – UNIT MASONRY.
 - b. Larger penetrations requiring a lintel shall be provided under Section 042000 – UNIT MASONRY, with lintels furnished under Section 055000 – METAL FABRICATIONS where required.

FABRICATIONS.

3. Structural criteria for new openings in masonry walls: Bring the following conditions to the attention of the Structural Engineer for determination of whether a lintel or other reinforcement will be required.
 - a. Non-load-bearing masonry walls: Any opening wider than one block or 16 inches.
 - b. Load-bearing masonry walls: Any opening wider than 6 inches.
- F. New Penetrations in Non-Masonry Construction:
1. Exposed locations: Cutting and patching shall be provided by the trade(s) responsible for surrounding construction.
 2. Concealed locations: Cutting and patching shall be provided by the trade(s) responsible for surrounding construction.
 3. Locations at roof: Cutting and patching of roof deck and substrate shall be coordinated with the work of Section 075400 – THERMOPLASTIC MEMBRANE ROOFING.

1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Structural elements include but are not limited to the following:
1. Reinforced concrete columns and beams. Coring of concrete foundation walls and slabs will be permitted where shown on drawings or required for mechanical and electrical work.
 2. Reinforced masonry bearing walls.
 3. Steel columns, beams, joists and connections.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include but are not limited to the following:
1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Partitions and other construction required to provide acoustical separation.
 4. Fire-suppression systems.
 5. Mechanical systems piping and ducts.
 6. Control systems.
 7. Communication systems.
 8. Conveying systems.
 9. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:
1. Water, moisture, or vapor barriers.
 2. Membranes and flashings.
 3. Exterior curtain-wall construction.
 4. Equipment supports.
 5. Piping, ductwork, vessels, and equipment.
 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior

or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations. Refer to Section 015000 – Temporary Facilities and Controls for additional requirements.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
 2. Cutting of openings in roofs shall be delayed as long as feasible, and preferably until the Roofing Subcontractor is at the site and can provide permanent roof covering immediately. Otherwise, protect roof openings so made in a weathertight manner until permanent roof is installed. Protect existing roofing to remain. Do not damage or alter in-place roofing and flashing to remain when doing work under this Section. Refer to Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for additional requirements for protection from the weather.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and 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. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces, in such a manner as to ensure a minimal difference between the cut area and new materials when patched..
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Use extreme care when cutting through construction containing concealed mechanical and electrical lines. Coordinate cutting and patching work with the following work to be performed under Division 230000 and 260000 Sections.
 - a. Cut off pipe or conduit in walls or partitions to be removed.
 - b. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: 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.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 3. Restore damaged pipe covering to its original condition.
 4. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface con-

taining the patch. Provide additional coats until patch blends with adjacent surfaces.

5. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.4 DEBRIS REMOVAL AND CLEANING

- A. Dispose of all materials under Section 017400 – CLEANING AND WASTE MANAGEMENT.
- B. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 017400
CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for the following waste handling operations for the Work of the Contractor and all Subcontractors:
 - 1. Salvaging nonhazardous construction and demolition waste.
 - 2. Recycling nonhazardous construction and demolition waste.
 - 3. Disposing of nonhazardous construction and demolition waste.
- B. Related Sections include the following:
 - 1. Section 015000 – TEMPORARY FACILITIES AND CONTROLS, for environmental-protection measures during construction.
 - 2. Section 042000 – UNIT MASONRY, for disposal requirements for masonry waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorpora-

tion into the Work.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of minimum 90 percent by weight of total non-hazardous Construction and Demolition waste generated by the Work, not including land-clearing and associated debris.

1.5 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for the Notice to Proceed.
- B. Waste Management Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include separate reports for demolition and construction waste. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons (tonnes).
 - 4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
 - 5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Final Waste Management Report: Before request for Substantial Completion, submit three copies of a summary of all weight tickets collected for demolition and construction debris removal. The summary shall include the following information, by line item:
 - 1. Type of debris
 - 2. Date(s) of load disposal
 - 3. Name of facility to which debris was taken
 - 4. Ticket number(s)
 - 5. Number of loads, yards and total pounds for each type of debris
 - 6. Number of pounds recycled or salvaged for each type of debris
 - 7. Percentage of material recycled or salvaged for each type of debris
 - 8. Total quantity of waste in tons (tonnes)
 - 9. Total quantity of waste salvaged, both estimated and actual in tons (tonnes)
 - 10. Total quantity of waste recycled, both estimated and actual in tons (tonnes)
 - 11. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes)
 - 12. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

Note: For material that is removed from the site and does not generate a waste ticket, provide an estimate of the weight and volume of materials removed.

- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable

waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- G. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- H. Qualification Data: For Waste Management Coordinator and refrigerant recovery technician.
- I. 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.

1.6 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: 5 years minimum experience.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste management plan, and cost/revenue analysis. Include separate sections in plan for demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Management Plan: Contractor will develop a Waste Management Plan that details the following:
 - 1. The 90% diversion percentage goal.
 - 2. Deconstruction, salvage, and recycling/reuse strategies and processes, e.g., scheduling

- of different stages of deconstruction to best remove recyclable or salvageable materials intact.
3. Methods of on-site communication directing the contractors and subcontractors regarding what, when, how and where to recycle.
 4. Documents needed to show waste diversion - e.g., weight tickets for all wastes removed from the site, including recycled and salvaged materials. If items are removed, and no weight tickets are generated, document the materials and date, estimate the weight and volume of the materials, and add them into the overall total for waste and/or salvaged/recycled material removed from the site.
 5. A method for collecting all recycling and waste data and organizing it for an audit of the recycling rates on the project.
 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
 7. List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - a. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - b. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - c. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - d. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - e. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
1. Total quantity of waste.
 2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
 3. Total cost of disposal (with no waste management).
 4. Revenue from salvaged materials.
 5. Revenue from recycled materials.
 6. Savings in hauling and tipping fees by donating materials.
 7. Savings in hauling and tipping fees that are avoided.
 8. Handling and transportation costs. Include cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.
- E. Forms: Prepare waste management plan on forms acceptable to the Architect.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement waste management plan as approved by Architect. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
 - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- E. Weight Tickets: Contractor shall collect weight tickets for all wastes removed from the site, including recycled and salvaged materials. If items are removed, and no weight tickets are generated, document the materials and date, estimate the weight and volume of the materials, and add them into the overall total for waste and/or salvaged/recycled material removed from the site.
- F. Final Summary: At Substantial Completion, Contractor shall provide a summary of all weight tickets collected for demolition and construction debris removal. The summary shall include the following information, by line item:
 - 1. Date of load disposal
 - 2. Name of facility to which debris was taken
 - 3. Ticket number
 - 4. Type of debris
 - 5. Number of loads, yards and total pounds for each line item
 - 6. Number of pounds recycled for each line item
 - 7. Percentage of material recycled for each line item
 - 8. Totals for each figure listed above.

3.2 SALVAGING DEMOLITION WASTE

- A. Not applicable.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Not applicable.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces

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and areas.

- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 017700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Final cleaning
 - 2. Temporary and trial usage
 - 3. Warranties and bonds
 - 4. Closeout requirements
 - 5. Inspection and Submittals for Substantial Completion
 - 6. Monetized Punch List Inspections
 - 7. Final Inspection and Submittals
 - 8. Final application and certificate for payment
 - 9. Post-construction inspection
- B. Related Work includes, but is not limited to, the following Work under other Sections:
 - 1. Dates for Substantial Completion and Final Completion: Section 002113 – INSTRUCTIONS TO BIDDERS.
 - 2. Procedures related to Architect's additional services if required to complete closeout of Project: Section 011400 – WORK RESTRICTIONS
 - 3. Construction schedule requirements: Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 - 4. Verification of performance of mechanical and electrical systems: OWNER COMMISSIONING: Sections 019113, 210800, 220800, 230800, 260800, and 280800.
 - 5. Temporary facilities to be removed at the end of the Project: Section 015000 – TEMPORARY FACILITIES AND CONTROLS.
 - 6. Documents to be submitted as part of Closeout Requirements: Section 017839 – PROJECT RECORD DOCUMENTS

1.3 SUBMITTALS

- A. Warranties and Bonds: As specified herein.
- B. Punch Lists: As specified herein.
- C. Submittals for Substantial Completion: As specified herein.
- D. Final Submittals: As specified herein.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Refer to Section 011400 WORK RESTRICTIONS for cleaning materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Before final inspection, thoroughly clean the entire exterior and interior areas of the building where construction work has been performed, the immediate surrounding areas, and corridors, stairs, halls, storage areas, temporary offices, and toilets.
 - 1. Allow adequate time in Construction Schedule to perform thorough final cleaning of entire Project for each phase.
- B. Refer to Section 011400 WORK RESTRICTIONS for general requirements for cleaning and for cleaning products, and refer to individual specification sections for cleaning requirements for particular products.
- C. Employ professional cleaners for final cleaning operations.
- D. Remove all construction facilities, debris, and rubbish from the Owner's property and legally dispose of same beyond site limits.
- E. Broom clean exterior paved surfaces, and rake clean other surfaces of the grounds.
- F. Sweep, dust, wash, and polish all finished surfaces. This includes cleaning of the Work of all finished trades where needed, whether or not cleaning for such trades is included in their respective Sections.
- G. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.
- H. Leave pipe and duct spaces, chases, and furred spaces thoroughly clean.
- I. Wash and polish all new glass on both sides, such Work shall be performed by a contractor specializing in a window cleaning work.

- J. Clean all ceilings, wall surfaces, floors, window and door frames, hardware, metal work, glass, glazing, enameled metals, and the like.
- K. Repair, patch and touchup marred surfaces to specified finish, to match adjacent surfaces.
- L. Each Subcontractor for mechanical and electrical work, including Plumbing, HVAC, Fire Protection, and Electrical Work shall clean materials and equipment for which they are responsible, leaving the Work in a finished and clean state.
- M. For each mechanical unit that has been in operation during construction, Contractor shall clean permanent filters and replace disposable filters with new filters as specified for that mechanical unit, and shall also clean ducts, blowers and coils associated with that unit.
- N. Prior to final completion, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire Work is clean.
- O. Owner will assume responsibility for cleaning as of time designated on Certificate of Substantial Completion for Owner's acceptance of Work or portion thereof.

3.2 TEMPORARY AND TRIAL USAGE

- A. Temporary or trial usage by Owner of any mechanical device, machinery, apparatus, equipment, or any Work or materials supplied under the Contract before final completion and written acceptance by the Architect shall not be construed as evidence of acceptance as same.
- B. The Owner reserves the privilege of such temporary or trial usage for such reasonable time as required to properly test such item. Claims for damages due to injury to or breaking of any parts of such Work, when the determined cause is weakness or inaccuracy of structural parts, defective material or workmanship, will not be allowed.
- C. If the Owner so requests, place an approved person or persons to instruct and assist in such trial usage and bear the costs therefore. Trials shall be made under the Architect's supervision.

3.3 WARRANTIES AND BONDS

- A. Compile specified warranties and bonds, review to verify compliance with Contract Documents, and submit to Architect for review and subsequent transmittal, if approved, to the Owner.
- B. Assemble two original signed copies of warranties, bonds and service and maintenance contracts executed by Officers of each of the respective manufacturers, suppliers and subcontractors.
- C. Neatly type Table of Contents in orderly sequence. Provide complete information for each item:
 - 1. Product or work item identification.
 - 2. Manufacturing or supplying firm, with name of principal, address and telephone number.
 - 3. Scope of work and of warranty provided.
 - 4. Date of beginning of warranty, bond or service and maintenance contract. Commence upon date of Substantial Completion for each phase.

5. Duration of warranty, bond or service maintenance contract. (In no case less than one (1) year).
6. Information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect validity of warranty or bond.
7. Contractor, name of responsible principal, address and telephone number.

D. Form of Submittals: Prepare in duplicate packets and in the following format:

1. Size: 8-1/2" x 11". Punch sheets for 3-ring binder. Z-Fold larger sheets to fit into binders.
2. Cover: Identify each packet with types or printed title "WARRANTIES AND BONDS". List Title of Project, Date and Name of Contractor.
3. Binders: Commercial quality, three-"D"-ring, with durable and cleanable plastic covers.

E. Time of Submittals:

1. For equipment or component parts of equipment put into service during progress of construction, submit documents within ten (10) days after inspection and acceptance. Otherwise, make submittals before Date of Substantial Completion.
2. For items of Work where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing the date of acceptance as the start of the warranty period.

F. Submittals Required: Submit warranties, bond, service and maintenance contracts as specified in the respective Sections of the Specifications.

3.4 CLOSEOUT REQUIREMENTS

- A. Punch List For Each Phase: When the Contractor submits a complete list of items to be completed or corrected in accordance with subparagraph 9.8.2 of the GENERAL CONDITIONS and the Architect receives the list, the Architect will make an inspection to determine whether the Work or designated portion is substantially complete, for each phase. The Contractor shall submit a schedule indicating when each item will be completed.
- B. If the Architect determines that the Contractor's list is not complete, the Architect will notify the Contractor. The Contractor shall provide a complete list before the Architect will complete his inspection.
- C. If the Architect's inspection discloses any item whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Architect will add the item to the list and will issue a punch list of items to be completed or corrected before final payment will be made. Such punch list shall not be construed as all-inclusive of the work which the Contractor will be required to perform before final payment.
- D. Substantial Completion for Each Phase: Architect will prepare and issue a Certificate of Substantial Completion, AIA G704, complete with signatures of Owner and Contractor, accompanied by list of items to be completed or corrected, as verified and amended by the Architect. Architect will not issue certificates of Substantial Completion until the items listed below in Articles 3.5 and 3.6 have been completed and submitted.

3.5 INSPECTION FOR SUBSTANTIAL COMPLETION

- A. In preparation for Substantial Completion, the Contractor shall submit written certification that:
 - 1. Contract Documents have been reviewed.
 - 2. Work has been inspected for compliance with Contract Documents.
 - 3. Work has been completed in accordance with Contract Documents.
 - 4. Equipment and systems have been tested in presence of Owner's Representative and are operational.
 - 5. Work is completed, and ready for inspection.
- B. Architect will begin inspection within seven (7) days after receipt of above referenced Contractor's Certification.
- C. Should the Architect consider the Work is substantially complete in accordance with requirements of Contract Documents, the Architect will request Contractor to make Project Closeout submittals.
- D. Should the Architect consider that the Work is not substantially complete:
 - 1. The Architect will notify Contractor, in writing, stating reasons.
 - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to the Architect certifying that the Work is complete.

3.6 SUBMITTALS FOR SUBSTANTIAL COMPLETION

- A. Contractor shall submit the following items at Substantial Completion:
 - 1. Operating and Maintenance Data.
 - 2. Schedule for training and instruction on new mechanical and electrical systems.
 - 3. Guarantees and Warranties.
 - 4. Keys and keying schedule.
 - 5. Spare Parts and Maintenance Materials.
 - 6. Roofing Guarantee and Flashing Endorsement.
 - 7. Evidence of Compliance with requirements of governing authorities.
 - 8. Punch list with schedule.
 - 9. Final Record Documents
- B. Evidence of compliance with authorities' requirements shall include:
 - 1. Certificates of compliance for flame and smoke, and fire rating.
 - 2. Certificates of Inspection:
 - a. Mechanical
 - b. Electrical
 - 3. Certificate of Occupancy
- C. Submit Certificate of Insurance for products and completed operations.
- D. Instructions: Instruct Owner's personnel in the operation of all systems, mechanical, electrical and other equipment.

3.7 MONETIZED PUNCHLIST INSPECTIONS

- A. Within 30 days of Substantial Completion, the Architect will produce a Monetized Punch List that assigns a monetary value to each item remaining incomplete or incorrect.
- B. The Contractor may request two inspections by the Architect after receipt of the Monetized Punch List, for the purpose of documenting progress toward completion of items on the List.
 - 1. If the Architect is required to inspect the Work more than three times prior to establishment of Final Completion, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional inspections, until the Work is considered Finally Complete.
 - 2. Refer to Section 011400 WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible for costs for Additional Services of the Architect.

3.8 FINAL INSPECTION

- A. The Contractor shall complete or correct all remaining items on the Monetized Punch List in accordance with the time limits stated in the General Conditions.
- B. Certification of Final Completion: When the Contractor considers that all of the items on the Monetized Punch List have been completed or corrected, the Contractor shall submit written certification that the items on the Monetized Punch List have been completed and corrected. This certification shall include a copy of the Monetized Punch List with the following information added:
 - 1. Indicate beside each item the date when the item was completed or corrected and,
 - 2. In the case of items completed by subcontractors or sub-subcontractors, the name of the Subcontractor or Sub-subcontractor.
- C. The Architect will begin inspection within seven (7) days after receipt of such certification, to determine whether items on the Punch List have been completed.
 - 1. Should the Architect determine that the Work is not complete after receipt of the certification of Final Completion, the Contractor shall be responsible to the Owner for costs for Additional Services of the Architect to perform additional inspections, until all items on the Punch List are completed.
 - 2. Refer to Section 011400 WORK RESTRICTIONS, for procedures required in cases where Contractor is responsible for costs for Additional Services of the Architect.

3.9 FINAL SUBMITTALS

- A. Contractor's Affidavit of Payment of Debts and Claims, AIA G706.
- B. Contractor's Affidavit of Release of Liens, AIA G706A, with:
 - 1. Consent of Surety to Final Payment: AIA G707.
 - 2. Contractor's release or waiver of liens.
 - 3. Separate releases or waivers of liens for subcontractors, suppliers and others with lien rights against property of Owner, together with list of those parties.
- C. All submittals shall be duly executed before delivery to the Architect.

3.10 FINAL APPLICATION AND CERTIFICATE FOR PAYMENT

- A. Contractor shall submit final application for payment in accordance with requirements of the GENERAL CONDITIONS.
- B. Architect will issue final certificate in accordance with provisions of Conditions of the Contract.
- C. Prior to issuance of the Certificate for Final Payment by the Architect, all requirements contained in this Paragraph entitled "Closeout Requirements" and other requirements of the Conditions of the Contract shall be executed, received and approved by the Architect.

3.11 POST-CONSTRUCTION INSPECTION

- A. 10 months after Date of Substantial Completion the Architect and the Owner's Project Manager will make visual inspection of Work in company with Owner and Contractor to determine whether correction of Work is required, in accordance with provisions of GENERAL CONDITIONS AND SUPPLEMENTARY GENERAL CONDITIONS.
- B. For guarantees beyond one year, the Owner's Project Manager will make inspection at request of Owner after notification to Contractor.
- C. Owner's Project Manager will promptly notify Contractor in writing of any observed deficiencies.

END OF SECTION

SECTION 017839
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. Record prints
 - 2. Final record drawings
 - 3. Operations and maintenance submittals and instructions.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Availability and restriction for use of project electronic files: Section 011400 Work Restrictions.
 - 2. Photographic documentation of construction: Section 011400 Work Restrictions.
 - 3. Availability of electronic files for preparation of record documents: Section 011400 Work Restrictions.
 - 4. Surveying and field engineering: Section 013100 Project Management and Coordination.
 - 5. General requirements for submittals: Section 013300 Submittal Procedures.
 - 6. Other submittals required at the completion of the Work: Section 017700 Closeout Procedures.

1.3 DEFINITIONS

- A. Record Prints are full sets of black-line of Contract Drawings, kept at the Project Site and marked regularly to record as-built conditions as specified herein.
- B. Final Record Drawings: Electronic files in DWG format prepared from completed and approved Record Prints.
- C. Final Record Coordination Drawings: Electronic files in DWG format prepared from updated prints of approved coordination drawings, to record as-built conditions.

1.4 SUBMITTALS

- A. Record Prints: Periodic submittal of prints of Drawings marked to indicate Work completed and changes in the Work, as specified in this Section:
 - 1. Record Prints
 - 2. Coordination Drawing Record Prints
- B. Final Record Drawings: Reproducible drawings, as specified in this Section:
 - 1. Final Record Drawings
 - 2. Final Record Coordination Drawings
- C. Operations and Maintenance Submittals:
 - 1. Maintenance Manuals
 - 2. Schedule of Training and Instruction for mechanical and electrical systems.

PART 2 - PRODUCTS

2.1 RECORD DOCUMENTS, GENERAL

- A. The General Contractor shall maintain Record Prints of site plans, landscape drawings, architectural drawings, and structural drawings.
- B. Filed Sub-Contractors shall maintain Record Prints of the Work of the following Sections:
 - 1. Section 210000 - Fire Protection.
 - 2. Section 220000 – Plumbing.
 - 3. Section 230000 – Heating, Ventilating, and Air Conditioning.
 - 4. Section 260000 – Electrical Work.

2.2 RECORD PRINTS

- A. During the progress of the Work, the General Contractor shall keep on file at all times two (2) complete and separate sets of black line prints of the entire set of Contract Drawings. Each set shall be updated daily to record the following information:
 - 1. Status of Work: One set shall be used to indicate the progress of the Work installed by coloring in the various pipelines, ducts, and apparatus as erected.
 - 2. Revisions: The second set shall be accurately and promptly updated with colored inks, daily as the Work progresses, to accurately record all revisions to the Work, including, but not limited to, the following:
 - a. Fire Protection, Plumbing, Heating and Ventilating, and Electrical Work, whenever Work was installed other than as shown on the Contract Drawings or described in the Specifications
 - b. Locations, elevations, sizes, and other aspects of all concealed and buried utilities, ducts, and services, including exterior utility and storm drainage lines.
 - c. The General Contractor shall be responsible for assuring that the various revisions are delineated by the specific trades involved.

3. Both sets shall be kept available at all times for use and inspection by the Architect and the Owner.
 4. Schedule monthly meetings to review the progress of record prints with the Architect. The progress set must be approved by the Architect in order to be included in the monthly pay application.
- B. Refer to Section 011400 Work Restrictions for Project Electronic Files to be made available for use by the Contractor in the preparation of Final Record Drawings.
- C. Transfer all information from the updated Record Prints to the electronic files at least once every three months.
1. Submit three prints of each updated drawing to the Architect at least three times during construction: when the work is approximately 1/4, 1/2, and 3/4 complete.
 2. When roughing in for any particular area is completed, it shall be shown on the Record Prints and a copy submitted for Architect's review.

2.3 FINAL RECORD DRAWINGS

- A. Before completion of the Work, and when directed by the Architect, the General Contractor and all indicated subcontractors shall perform the following:
1. Transcribe all previously recorded information from Record Prints onto the electronic files.
 2. Make all final changes and corrections to the electronic files for the Final Record Drawings.
 3. Signatures Required: The General Contractor or Filed Sub-Contractor shall sign each drawing for which they are responsible, as certification that the work was installed as shown.
 4. Deliver signed, completed Final Record Drawings to Architect.
- B. Acceptance by the Architect of the completed Final Record Drawings shall be a prerequisite for Substantial Completion.
- C. Shop Drawings will not be acceptable as Final Record Drawings for the Project.
- D. The Architect shall be the sole judge of the acceptability of Final Record Drawings.
- E. Special Requirements for Final Record Drawings of Site Work:
1. Record Drawings for exterior utilities and other items below grade shall include accurate locations of the following:
 - a. The points where such items enter the building and property lines.
 - b. All turns, offsets, and other changes in direction below grade.
 - c. All valves and other appurtenances.
 2. Indicate locations of these items using dimensions to adjacent permanent benchmarks or structures as approved by the Architect. Reliance on scale only to locate any temporary or concealed construction will not be acceptable.
 3. Final Record Drawings for work below grade shall be submitted immediately upon completion of utility line installation and prior to concealment of the work
 4. Refer to Division 32 Sections for additional requirements for Final Record Drawings of

site work.

2.4 RECORD COORDINATION DRAWINGS

- A. Record progress of the Work and modifications and corrections on a set of prints of approved coordination drawings. Follow procedures as for Record Prints.
- B. Final Record Coordination Drawings shall be prepared using information from approved record copies of coordination drawings as for Final Record Drawings.

2.5 MAINTENANCE MANUALS

- A. Upon Substantial Completion of the Work, submit maintenance schedules, maintenance manuals, and all approved Shop Drawings, presenting full details for care and maintenance of visible surfaces and all equipment furnished and installed under the Contract.
- B. Maintenance manuals shall consist of manufacturer's catalog cuts with descriptive information, lubricating and maintenance instructions, parts lists, usage instructions, names, addresses and telephone numbers where replacement parts and service can be quickly obtained, and all other information required for the Owner to use, maintain, and service the items properly.
- C. Upon Architect's approval of drafts, submit two (2) corrected copies properly bound in a logical and well arranged order, with index, to the Architect for transmittal to the Owner. Provide a CD with electronic files (PDFs) of all information in and organized like the submitted and approved Manuals.

PART 3 - EXECUTION

3.1 TRAINING AND INSTRUCTIONS

- A. The Contractor shall arrange for instruction for the Owner's employees, to insure proper operation of the equipment furnished.
 - 1. It is the intent of this paragraph to require the Contractor and the applicable Subcontractors to furnish as much detailed instruction as is necessary to educate the Owner's on-site personnel in the proper use of the equipment.
 - 2. This instruction shall be provided by a qualified trainer who is also a manufacturer's certified technician with expertise with the specific system or equipment for which training is required. In some cases, this may require more than one visit to the Project by those responsible for the instruction.
 - 3. The Contractor and, in particular, the Plumbing, Heating and Ventilating, and Electrical Subcontractors shall not assume that the Owner's employees possess special expertise or have had any previous experience whatsoever in the operation and maintenance of sophisticated mechanical and electrical equipment.
 - 4. Submit the schedule for instructional sessions to the Owner. Do not proceed with instruction until Owner has approved schedule.
 - 5. Refer to specific technical sections for additional requirements specific to particular equipment and systems.

- B. For major items of mechanical and electrical equipment, instructions and demonstrations shall be performed during the initial start-up period and, if necessary, during one or more return visits as may be required.

- C. Video: Instruction sessions and demonstrations shall be video-recorded by professional videographers in DVD format, using tripods, broadcast-quality video cameras and proper lighting. Close-ups of items being demonstrated shall be included. Sound recording shall be clear and perfectly intelligible. DVD shall be edited as required to provide a permanent reference. Each session and demonstration shall be included, except where waived by the Architect, and all DVDs shall be properly labeled as to date, subject, and presenter. Provide two (2) copies of each DVD.

END OF SECTION

SECTION 018113

SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 OBJECTIVES

- A. To obtain acceptable water efficiency, energy efficiency, materials, site design, and Indoor Air Quality (IAQ) for the completed Project and minimize the environmental impacts of construction and operation, the Contractor during the construction phase of this project shall implement the following procedures singly or in combination:
 - 1. Select products that minimize consumption of non-renewable resources, consume reduced amounts of energy and minimize amounts of pollution to produce and transport, and employ recycled and/or recyclable materials. To help purchasers incorporate environmental considerations into purchasing decisions, it is the intent of this project to conform with EPA's Five Guiding Principles on environmentally preferable purchasing. The five principles are:
 - a. Include environmental considerations as part of the normal purchasing process.
 - b. Emphasize pollution prevention early in the purchasing process.
 - c. Examine multiple environmental attributes throughout a product's or service's life cycle.
 - d. Compare relevant environmental impacts when selecting products and services.
 - e. Collect and base purchasing decisions on accurate and meaningful information about environmental performance.
 - 2. Control sources for potential IAQ pollutants by controlled selection of materials and processes used in Project construction in order to attain superior IAQ.
 - 3. Products and processes that achieve the above objectives to the extent currently possible and practical have been selected and included in these Construction Documents. The Contractor is responsible to maintain and support and quantify these objectives in developing means and methods for performing the work of this Contract and in proposing product substitutions and/or changes to specified processes.

1.3 DESCRIPTION OF WORK

- A. Work Included: General requirements and procedures for compliance with current Version of the Massachusetts Collaborative for High Performance Schools (MA-CHPS) Guidelines, including all prerequisites and credits needed for the Project to be MA-CHPS Verified Leader.

1. Compliance with requirements needed to obtain MA-CHPS prerequisites and credits may be used as one criterion to evaluate substitution requests.
2. Refer to the MA-CHPS Scorecard attached at the end of this Section for required credits.
3. Owner shall register project with the National CHPS organization and pay all registration and review fees.
4. Owner shall pay CHPS the costs of interpretations, certification and other administrative fees.

B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Divisions 01 through 33 Sections for MA-CHPS requirements specific to the work of each of these Sections. Requirements may or may not include reference to MA-CHPS.

1.4 DEFINITIONS

- A. Agrifiber Products: Composite panel products derived from agricultural fiber.
- B. Composite Wood: A product consisting of wood fiber or other plant particles bonded together by a resin or binder.
- C. MA-CHPS: Massachusetts Collaborative for High Performance Schools Guidelines, 2009 version.
- D. Rapidly Renewable Materials: Materials made from plants that are typically harvested within a 10-year or shorter cycle. Rapidly renewable materials include products made from cork, bamboo, wheat, cotton, flax, jute, straw, sunflower seed hulls, vegetable oils, or wool.
- E. Forest-Stewardship Council (FSC) Certified Wood: Wood products bearing the FSC label come from forests that are managed in environmentally responsible, socially beneficial, and economically viable ways
- F. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship." Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.
- G. Post-Consumer Recycled Content: Defined as materials or finished product that has served its intended consumer use and has been discarded by the consumer for recovery after use (e.g., plastic soda bottle).
- H. Post-Industrial Recycled Content: Defined as recovered industrial and manufacturing material that is recycled. Scrap raw materials that can be reused in the same manufacturing process from which they were recovered are not considered Post-Industrial Recycled Content. Fly-ash and synthetic gypsum, because they are waste products from coal burning electricity plants, are examples of Post-Industrial Recycled Content.
- I. Salvaged or Reused Materials: Materials extracted from existing buildings in order to be reused in other buildings without be manufactured.

- J. Regionally Produced Materials: Materials manufactured within five hundred miles radius of the project site. The location of manufacture refers to the final assembly of components into the building product that is furnished and installed by tradesmen.

1.5 SUBMITTALS

- A. General: Submit additional MA-CHPS submittals required by other Specification Sections.
- B. MA-CHPS submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated MA-CHPS requirements.

PART 2 - PRODUCTS

2.1 LOW-EMITTING MATERIALS

- A. The following products and systems, where installed inside the weatherproofing system, shall meet the testing and product protocols listed below.
 - 1. Paints: All paints and architectural coatings totaling 90% or more of the total volumes of such products applied in the project's interior shall meet the requirements as described in MA-CHPS 2009 Guidelines, inclusive of SCAQMD Rule 1113, Architectural Coatings.
 - 2. Composite Wood and Agrifiber Products: At least 90%, by area, of the composite wood and agrifiber products installed in the project's interior shall meet the requirements as described in MA-CHPS 2009 Guidelines. All such products shall be manufactured with no-added formaldehyde based resins and shall meet the emission requirements established by ATCM for such products.
 - 3. Adhesive and Sealants: All adhesives and sealants used on the project in quantities of 2.5 gal (10 liters) or more and totaling 90% or more of the total volumes of such products applied in project's interior shall meet the requirements as described in MA-CHPS 2009 Guidelines, inclusive of SCAQMD Rule 1168, Adhesive and Sealant Applications. Further, all flooring, wall covering and wall base adhesives and sealants shall be tested and evaluated for emissions of VOCs following the specifications of CDPH.
 - 4. Flooring Systems: All flooring systems installed in the project's interior totaling 90% or more of the total floor area of the project shall meet the requirements as described in MA-CHPS 2009 Guidelines. Flooring systems shall be tested and evaluated for emissions of VOCs following the specifications of the CDPH Standard Practice.
 - 5. Ceiling and Wall Systems: All ceiling and wall systems installed in the project's interior totaling 90% or more of the total areas of such systems shall meet the requirements as described in MA-CHPS 2009 Guidelines. Systems shall be tested and evaluated for emissions of VOCs following the specifications of the CDPH Standard Practice.
- B. For each low-emitting material or product, Contractor shall supply documentation verifying that it is certified as a low-emitting material in accordance with Scientific Certification System's FloorScore or Indoor Advantage Gold Program, or with GreenGuard's Children and Schools Program, or with the Carpet and Rug Institute's Green Label Plus Program, OR that the product is listed at www.chps.net in the CHPS Products Database, OR that the product was independently tested and has been shown to meet the Chronic Reference Exposure Levels (CRELs) for the VOCs identified by the California Office of Environmental Health Hazard Assessment (OEHHA).

- C. For each low-emitting material or product, Contractor shall fill out the Materials Submittal Cover Sheet identifying the certification program that the material or product meets.
- D. Do not use composite wood, agrifiber products and laminating adhesives that contain added urea-formaldehyde resins.

2.2 HIGH ALBEDO ROOFING MATERIALS

- A. For exposed roofing membranes, pavers, and ballast products, provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying the following minimum Solar Reflectance Index (SRI) values:
 - 1. 78 for low-sloped roofing applications (slope less than or equal to 2:12).
 - 2. 29 for steep-sloped roofing applications (slope greater than 2:12)
- B. SRI values shall be calculated according to ASTM E 1980. Reflectance shall be measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance shall be measured according to ASTM E 408 or ASTM C 1371. Vegetated roof surfaces, skylights, and photovoltaic panels are exempt from the SRI criteria.

2.3 RECYCLED CONTENT OF MATERIALS

- A. For all building materials and products with the exception of plumbing, mechanical and electrical components and specialty items, such as elevators, contractor shall determine the percentage of Post-Consumer recycled content and/or Total Recycled Content and fill out the Materials Submittal Cover Sheet located at the end of this section with that information.
- B. For each item containing recycled content Contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.
- C. Contractor shall submit manufacturer product data, product literature or a letter on manufacturer letterhead verifying the percentage of post-consumer recycled content, total recycled content or both contained in each material listed in the Materials Submittal Cover Sheet. Contractor may also submit documentation from a third party certifier, such as Scientific Certification Systems (SCS) certifying that a product contains designated percentages of recycled content.
- D. Utilize all on-site existing paving materials that are scheduled for demolition as granulated fill, and include the cost of this material had it been purchased in the calculations for recycled content value. The asphalt shall be crushed to the requirements of the project specifications Earthwork-310000, 2.01, B, the reuse of reclaimed/recycled asphalt is acceptable for reuse as base course material directly below proposed new paved driveway and parking areas.
- E. Verification of post-consumer and total recycled content percentages are required for all relevant materials including but not limited to:
 - 1. Division 03 – Concrete
 - 2. Division 05 - Metals
 - 3. Division 06 – Wood, Plastics and Composites
 - 4. Division 07 – Thermal and Moisture Protection
 - 5. Division 09 – Finishes
 - 6. Division 10 – Specialties
 - 7. Division 12 – Furnishings
 - 8. Division 31 – Earthwork

9. Division 32 – Exterior Improvements

- F. Provide materials and products with recycled content levels in accordance with MA-CHPS *Table 15 – Minimum Recycled Content Levels (MW.C2: Recycled Content, Prescriptive Approach)*, or in accordance with the MA-CHPS Performance Approach. Refer to pages 149 and 150 of the Massachusetts MA-CHPS Criteria publication attached at the end of this section.

2.4 RAPIDLY RENEWABLE MATERIALS

- A. Rapidly renewable raw materials are those materials that substantially replenish themselves faster than traditional extraction demand and are sustainably managed.
- B. For all rapidly renewable materials, contractor shall provide documentation indicating compliance with MA-CHPS *Table 16 – Materials to be Included and Excluded from Calculations*, or in accordance with the MA-CHPS Prescriptive Approach. Refer to pages 153 and 154 of the Massachusetts MA-CHPS Criteria publication attached at the end of this section.

2.5 CERTIFIED WOOD

- A. For all wood-based materials, contractor shall identify the percentage of product that contains wood certified by the Forest Stewardship Council (FSC), and shall fill out the Materials Submittal Cover Sheet located at the end of this section with that information.
- B. For each item containing FSC-Certified wood Contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.
- C. Provide vendor invoices for each wood product stating whether or not it has been harvested in accordance with the “FSC Principles and Criteria” for well-managed forests developed by the Forest Stewardship Council (FSC). Invoices shall include chain-of-custody (COC) certificate numbers and itemized costs for all certified products.
- D. Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
- a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Heavy timber construction.
 - d. Wood decking.
 - e. Particle board.
 - f. Plywood.
 - g. Metal-plate-connected wood trusses.
 - h. Structural glued-laminated timber.
 - i. Finish carpentry.
 - j. Architectural woodwork.
 - k. Wood paneling.
 - l. Wood veneer wall covering.
 - m. Wood flooring.
 - n. Wood lockers.
 - o. Wood cabinets.
 - p. Wood doors.
 - q. Non-rented temporary construction, including bracing, concrete formwork, pedestrian barriers, and temporary protection.

2.6 REGIONAL MATERIALS

- A. For all building materials and products with the exception of plumbing, mechanical and electrical components and specialty items, such as elevators, contractor shall determine if the product is manufactured within 500 miles radius of the project site and fill out the Materials Submittal Cover Sheet located at the end of this section with that information. Lighting fixtures are to be included in the locally produced materials calculation.
- B. For each item produced in the 500 miles radius, Contractor lists in the Materials Submittal Cover Sheet, Contractor shall also show the installed cost.
- C. Contractor shall submit manufacturer product data, product literature or a letter on manufacturer letterhead verifying the production location of each material listed in the Materials Submittal Cover Sheet. Contractor should also submit map showing the manufacture location is within the 500 miles radius.

2.7 COMPOSITE WOOD OR AGRIFIBER RESINS

- A. For all composite wood, engineered wood and agrifiber products to be installed on the interior of the building (including plywood, particleboard, and medium density fiberboard), provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that the products do not contain added urea formaldehyde resins. (This is a project requirement although not a MA-CHPS requirement.)

2.8 COMPOSITE WOOD OR AGRIFIBER LAMINATING ADHESIVES

- A. For all laminating adhesives used with composite wood, engineered wood and agrifiber products (e.g., adhesives used to laminate wood veneers to an engineered wood substrate), provide published product literature or letter from the manufacturer (on the manufacturer's letterhead) verifying that that the adhesive products do not contain urea-formaldehyde.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT

- A. Comply with Section 017400 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.2 INDOOR AIR QUALITY

- A. Comply with Section 018119 – INDOOR AIR QUALITY REQUIREMENTS.

3.3 PHOTOGRAPHIC DOCUMENTATION

- A. Provide photographic documentation in accordance with MA-CHPS requirements for all indicated sustainable design provisions.

3.4 MA-CHPS SCORECARD SUMMARY

- A. Comply with requirements of Scorecard Summary as developed by the Architect and attached to this Section.

3.5 MATERIALS SUBMITTAL COVER SHEET

- A. Documentation Sheet: Provide documentation for each material required for MA-CHPS Documentation in accordance with attached Materials Submittal Cover Sheet.

3.6 SECTION ATTACHMENTS

- A. The following sections are attached to this section as referenced herein.
 - 1. Massachusetts MA-CHPS Criteria publication, excerpts (pages 149, 150, 153, and 154).
 - 2. MA-CHPS Scorecard sheet.
 - 3. Materials Submittal Cover sheet.

END OF SECTION

Materials and Waste Management

MW.C2: Single Attribute – Recycled Content

Table 15 – Minimum Recycled Content Levels¹ (MW.C2: Recycled Content, Prescriptive Approach)

Total Recycled Content = Post-consumer Recycled Content + ½ Secondary Recycled Content

Note: If tire derived products are used indoors, it must also meet EQ.C3 standards for low-emitting materials.

Category	Product	Total Recycled Content	Post Consumer Recycled Content
Building Insulation	Fiberglass Insulation	30%*	30 %
	Cellulose Insulation (Including Cotton and Denom)	75%*	75 %
Flooring	Nylon Carpet (Total) Weight	10%*	10 %
	Polyester Carpet Fiber Face	25%*	25 %
	Plastic	40%	0 %
	Tire-derived Rubber	50%*	50 %
	Glass	50%*	50 %
	Ceramic	45%	0 %
Acoustical Ceiling Tiles and Wall Panels	Glass	30%	0 %
	Recycled Newspaper, Slag Wool, Aluminum	30%	0 %
Countertops	Paper	30%*	30 %
	Glass	50%*	50 %
	Ceramic Tile	45%	0 %
Cabinetry	Medium Density Fiberboard	80%	0 %
Wall Coverings	Tackable Wall Panels	100%*	100 %
	Paint	50%*	50 %
Aggregate Base and Subbase	Recycled Aggregate	50%	0 %
Structural Concrete	Fly Ash, Rice Hull Ash, or other Pozzolanic Materials (See credit restrictions on claiming credit for fly ash.)	25% ²	0 %
Structural Steel	Basic Oxygen Furnace (BOF) Produced Steel	16%*	16 %
	Electric Arc Furnace (EAF) Produced Steel	67%*	67 %
Shower/Restroom Partitions	Plastic	20%	0 %
	Steel	25%	0 %
Windows	Fiberglass Frame	15%	0 %
Roofing Materials	Steel	25%	0 %
	Aluminum	20%	0 %
	Fiber (Felt) or Fiber Composite	50%*	0 %
	Tire-derived Products	50%*	50 %

¹ Table A2 is adapted from the US EPA Comprehensive Procurement Guidelines. www.epa.gov/cpg/

* Note: Asterisked products must meet their minimum total recycled content level entirely with post-consumer (collected from end-users) content. For all other products, secondary recycled content (also known as post-industrial or pre-consumer) may count as half credit toward the minimum total recycled content required. For example, the 30% total recycled content requirement for acoustical ceiling tiles could be met by a product with 60% secondary content or one with 10% post-consumer content and 40% secondary recycled content.

² Recycled content levels must not exceed recommended CA Division of the State Architect (DSA) guidelines.

Materials and Waste Management

MW.C2: Single Attribute – Recycled Content

	Plastic or Plastic/ Rubber Composite	100%*	100 %
Playground Equipment	Plastic	90%	90 %
	BOF Steel, EAF Steel	16%, 67%	16 %, 67 %
	Aluminum	25%*	25 %
Playground Surfaces	Plastic	10%*	10 %
Landscaping Products	Compost, Co-compost, and Mulch	80%*	80 %
Plastic Lumber and Timbers	Plastic	10%*	10 %
Parking Stops	Plastic	10%*	10 %
	Tire-derived Products	100%*	100 %
New product categories may be considered provided the value exceeds 5% of the total project material cost. See ME 4.1.2 which states that a default value of 35 % of the Total Construction Cost can be used for Total Project Material Cost. i.e. for a \$5 major modernization project take 35 % of that cost then 5 % of that cost and a new product category would need to be worth at least \$87,500 to be considered		20%	10%
All Other Product Categories (Maximum of 2 points from this category are eligible for credit under ME4.1. To receive credit, products must also complete a Life Cycle Effects Screening (LCES) to ensure there are no environmental or health tradeoffs).		25%	0 %

Performance Approach:

Another method to verify compliance with this credit is to use the performance approach. The weighted average of recycled-content value is calculated using the following equations:

- Recycled Content Value (RCV): Calculate the Recycled Content Value of each product by multiplying the cost of the product by the percent of postconsumer recycled content and then adding ½ of the cost of the product multiplied by the percent of secondary recycled content. Material Cost is the construction cost of each individual material excluding all labor costs, project overhead, and fees.

$$RCV = (\% \text{ postconsumer recycled content} \times \text{material cost}) + 0.5 \times (\% \text{ secondary recycled content} \times \text{material cost})$$

- Total Recycled Content Value: Total Recycled-content Value is the sum of the postconsumer and secondary recycled-content value of all recycled-content products.

$$\sum RCV = RCV \text{ Product A} + RCV \text{ Product B} + RCV \text{ Product C, etc.}$$
- Verify RCV of Each Recycled Product DOES NOT Exceed 25% of $\sum RCV$: If RCV of Product A is greater than 25% of $\sum RCV$, then 25% ($\sum RCV$) must be substituted for the value of Product A in the Total Recycled Content Value equation. This step must be repeated for each product to verify that no one material accounts for more than 25% of the $\sum RCV$.

$$RCV \text{ Product A} \leq (25\%) (\sum RCV)$$



Materials and Waste Management

MW.C3: Single Attribute – Rapidly Renewable Materials

Table 16 – Materials to be Included and Excluded from Calculations

Division	Name	Included in the cost calculation	Not included in the cost calculation	Notes on DHS Materials Testing
1	General Conditions	Not Applicable	Not Applicable	Not applicable
2	Site Work	Site furnishings, bike racks, site paving systems (including asphalt, concrete for sidewalks and driveways as well as other paving systems), gravel, fences and gates, parking lot accessories, play ground surfaces, and play ground equipment.	Plant materials, earth, sand and outdoor lighting fixtures (see Division 16).	No testing required.
3	Concrete	All products. Include all concrete used in the construction of the building: slabs, structural concrete, basement walls and concrete toppings on steel or wood decks. Concrete used in site work is also included, but in Division 2.	Formwork and temporary scaffolding.	No testing required.
4	Masonry	All products. Include all masonry used in the construction of the building, both structural and otherwise. Masonry used in site work is also included, but in Division 2.	Nothing	No testing required.
5	Metals	Light gauge metal framing for walls, roofs or floors, wood structural connectors, metal roofing, decorative metal, guard rails and hand rails. Aluminum or steel used in the manufacturing of windows and doors is included in Division 8.	Structural steel including steel reinforcing bars or meshes used in concrete.	No testing required.
6	Wood and Plastic	All products used in the permanent construction of the building.	Formwork, temporary fences, construction barriers, scaffolding, bracing, and other elements that are not part of the finished building.	Only applies for materials that are exposed to the interior space. If people can see from inside it you have to test it. Most structural wood products would not need to be tested: framing lumber, OSB, and plywood.
7	Thermal and Moisture Protection	All products. All insulation used in walls, roofs, floors and slabs as well as insulation used for pipes and ducts. All air barriers and vapor barriers.	Nothing	Testing required.
8	Doors and Windows	All products	Nothing	No testing required.
9	Finishes	All products	Nothing	Everything has to be tested.
10	Specialties	All products	Nothing	Testing only required for surface mounted whiteboards and tack boards.
11	Equipment	Nothing is included.	All products	No testing required.
12	Furnishings	Fixed casework and other built-items	Moveable desks, tables, chairs, cabinets and bookcases that are not in the construction contract. Generally everything that is not bolted down is excluded.	Testing required.
13	Special Construction	Excluded	All Products	No testing required.

Materials and Waste Management

MW.C3: Single Attribute – Rapidly Renewable Materials

<i>Division</i>	<i>Name</i>	<i>Included in the cost calculation</i>	<i>Not included in the cost calculation</i>	<i>Notes on DHS Materials Testing</i>
14	Conveying Systems	Excluded	All products	No testing required.
15	Mechanical	Excluded	All products	No testing required.
16	Electrical	Excluded	All products	No testing required.

Material cost is the construction cost of a material excluding all labor costs, project overhead, and fees. Divide the cost of all renewable materials by the total qualifying material cost and multiply by 100 to determine the percentage of renewable materials in the construction.

Renewable Raw Materials [%] = Renewable material cost[\$]/Total material cost[\$] x100 Be sure to use the total qualifying materials cost for the project in the denominator of the calculation equation.

The prescriptive approach requires that 50% of all material from one of the listed groups meet the criteria. For example, a minimum of 50% of all floor coverings used in the school must contain 25% rapidly renewable raw materials based on weight. This calculation may use the formula above for the dollar value of the materials or may be calculated on the base unit:

$$\text{Renewable Raw Materials [\%]} = \text{Renewable Material Unit} / \text{Total Material Unit} \times 100$$

Applicability

This prerequisite applies to all projects.

Resources

CHPS Best Practices Manual: Volume II: Interior Surfaces and Finishes Chapter.

CHPS Product Database: <http://www.chps.net/dev/Drupal/node/445>

LEED™-NC 2.2 Reference Guide: Materials Credit 6: Renewable Materials.

LEED™-NC 2.2 Reference Guide: Materials Credit 7: Renewable Materials - Certified Environmentally Responsible Management.

CHPS Best Practices Manual: Volume II: Interior Surfaces and Finishes Chapter.

ISEAL Member certifying organizations: www.isealliance.org/membership

Sustainable Design Requirements - Materials Submittal Cover Sheet

Submittal Name		Contractor Name	
Submittal Number		Contractor Contact	

Type of Material (e.g., wood, CMU, structural steel)	Installed Cost (Note 1)	Recycled Content		% Forest Stewardship Council (FSC) Certified Wood (Note 4)	% Bio-Based Materials (Note 5)	Low-Emitting Materials Certification (Note 6)
		% Post-Consumer Content (Note 2)	% Post-Industrial Recycled Content (Note 3)			

Notes:

- 1 Installed Cost** - Insert the total cost of installing this material, including labor costs. CHPS will assume that on average the cost of labor for each individual material installation is 65% of the total installation cost.
- 2 Post-Consumer Recycled Content** - Insert percentage of post-consumer recycled content that this material contains. Post-consumer recycled content is defined as material or finished product that has served its intended consumer use and has been discarded by the consumer for recovery after use (e.g., plastic soda bottle). Submit manufacturer product data, product literature, or a letter on manufacturer letterhead verifying the percentage of recycled content.
- 3 Post-Industrial Recycled Content** - Insert percentage of post-industrial recycled content that this material contains. Post-Industrial Recycled Content is defined as recovered industrial and manufacturing material that is recycled. Scrap raw materials that can be reused in the same manufacturing process from which they were are examples of Post-Industrial Recycled Materials. Submit manufacturer product data, product literature, or a letter on manufacturer letterhead verifying the percentage of recycled content.
- 4 FSC Certified Wood** - Insert percentage of this wood product that is FSC-certified (certified by the Forest Stewardship Council). Wood products bearing the FSC label come from forests that are managed in environmentally responsible, socially beneficial, and economically viable ways. Submit vendor invoices showing chain-of-custody certificate numbers.
- 5 Bio-Based Materials** - Insert percentage of this material that is bio-based. Bio-based materials contain a significant amount of materials from natural fibers, plant stalks and leaves, and plant extractions. Examples are bamboo products, wheat grass cabinetry, and linoleum. Submit manufacturer product data, product literature, or a letter on manufacturer letterhead verifying the percentage of bio-based materials.
- 6 Low-Emitting Materials** - List the certification program that this product meets. You must supply manufacturer product data, product literature, a certificate from a third-party certifier, or a letter from the manufacturer documenting which testing standards or which certification program the material listed has been shown to meet. Examples are: SCS Indoor Advantage Gold (for adhesives, paints, acoustical ceiling tiles and more), SCS FloorScore (for resilient flooring and associated adhesives), GreenGuard Children and Schools (for adhesives, resilient flooring, paints, insulation, acoustical ceiling tiles and more), Carpet and Rug Institute's Green Label Plus (for carpet systems, including carpet backing and adhesives). Alternatively, acceptable products may be listed at www.chps.net in the CHPS Products Database. Submit documentation showing the program to which the material is certified or indicate that the product is listed at www.CHPS.net in the CHPS Products Database.

SECTION 018119
INDOOR AIR QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the Contract and General Conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, requirements for the following procedures:
 - 1. General procedures for protecting and maintaining indoor air quality.
 - 2. Selection of products.
 - 3. Mixing of multi-component products.
 - 4. Work procedures.
 - 5. Flushout procedures.
 - 6. Integrated pest management.
- B. Related work includes, but is not limited to, the following work under other Sections:
 - 1. Scheduling requirements for building flush-out: Section 013200 – Construction Progress Documentation
 - 2. Separate line item for IAQ Control measures in Schedule of Values: Section 012400 – Schedule of Values.
 - 3. Submittal procedures: Section 013300 – Submittal Procedures.
 - 4. Weatherproof enclosures and cleaning materials: Section 015000 - Temporary Facilities and Controls.
 - 5. Sustainable design requirements: Section 018113 – Sustainable Design Requirements.
 - 6. Sealing of air intakes during roofing installation: Section 075400 – Thermoplastic Membrane Roofing.
 - 7. Temporary and permanent filters and other provisions for air handling systems: Division 23 – MECHANICAL.

1.3 INTENT

- A. It is the intent of the Owner to maintain a healthful environment for the present and future occupants of the building. Therefore, the Contractor shall conduct the Work in such a way as to avoid creating indoor air quality problems. Required procedures include:

1. Limiting use of products that may contribute to poor indoor air quality.
 2. Maintaining work procedures which contain and alleviate dusts and odors and air-borne contaminants.
 3. Protection of materials from moisture.
- B. The Contractor's attention is directed to the provisions throughout the Contract Documents intended to maintain indoor air quality during construction and after completion of the Project. These provisions will be strictly enforced. The Contractor and Filed Sub-Bid Contractors shall notify and require each subcontractor, sub-subcontractor and materials vendor to comply with such provisions.
- C. Pest Control Impact on IAQ: With the intent of eliminating or minimizing the use of chemical pesticides, which can become airborne contaminants, the Contractor shall implement an Integrated Pest Management Plan (IPM), consistent with the requirements of the Massachusetts Legislature, Chapter 85 of the Acts of 2000, "An Act Protecting Children and Families from Harmful Pesticides", and IPM Guidelines issued by the Massachusetts Department of Food and Agriculture Pesticide Bureau.
1. Key aspects of pest control for this Project include:
 - a. Construction areas shall be kept clean to minimize residue that will serve as nutrients or harborage for insects and rodents.
 - b. No discarded food shall remain on the construction site overnight.
 - c. Application of chemical pesticides shall be considered a last resort after other methods have failed, and shall be performed by licensed pest control professionals.
 - d. Control of insects shall be performed using traps containing baits and gels.
 - e. Control of rodents shall be performed using mechanical traps.
 - f. Plant growth will be controlled by hand weeding wherever practical and the use of herbicides will be strictly limited, in accordance with the requirements of landscape Sections.
 2. The Contractor shall develop and implement IPM goals and procedures with respect to the control of pests during construction.
 3. Refer to specific technical Sections for pest control products and procedures to be incorporated into the Work in compliance with the Owner's IPM.

1.4 DEFINITIONS

- A. "IAQ": Indoor Air Quality.
- B. "MSDS": Material Safety Data Sheet.
- C. "REL": Reference Established Limit, a highest permissible concentration of a given airborne compound.
- D. "VOC": Volatile Organic Compound.
- E. "Work Area": The portions of the building or site given over to the Contractor for the construction of new Work required by the Contract Documents.

1.5 REFERENCE STANDARDS

- A. This Project has been designed to meet the following requirements and regulations. Where different criteria for a given component of the Work are not in agreement, the Contractor shall be required to meet the most restrictive criterion, unless otherwise indicated in the Contract Documents.
1. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE), 1999: ASHRAE Standard 62-1999, Ventilation for acceptable Indoor Air Quality.
 2. American Society for the Testing and Materials (ASTM):
 - a. ASTM D5116-97, Guide for Small Scale Environmental Chamber Determination of Organic Emissions from Indoor Materials/Products.
 3. The Commonwealth of Massachusetts, Department of Labor and Workforce Development, Division of Occupational Safety, Occupational Hygiene Program, 1997: "Preventing Indoor Air Quality Problems During Construction and Renovation."
 4. The Commonwealth of Massachusetts, Regulations: Table 310 CMR 7.25.
 5. Occupational and Safety and Health Administration (OSHA): Relevant standards on indoor air quality, including the following:
 - a. 29 CFR 1926.59, Hazard Communication
 - b. 29 CFR 1910.95, Occupational Noise Exposure
 - c. 29 CFR 1910.146, Permit Required Confined Spaces
 - d. 29 CFR 1910.1000, Air Contaminants
 - e. 29 CFR 1910.1200, Hazard Communication.
 6. Sheet Metal and Air Conditioning National Association (SMACNA): "Duct Cleanliness for New Construction Guidelines." Follow these guidelines to Advanced levels of cleanliness. Of specific importance are the following:
 - a. Ductwork shall be sealed when transported to the construction site.
 - b. Store ductwork in clean, dry conditions and keep sealed while it is stored.
 - c. Wipe down internal surfaces of ductwork immediately prior to installation to remove dust.
 - d. Seal open ends on completed ductwork and overnight work-in-progress.
 - e. During installation, protect ductwork waiting to be installed with surface wrapping.
 7. Collaborative for High Performance Schools; Massachusetts High Performance Schools Guidelines: Criteria.

1.6 PERFORMANCE REQUIREMENTS

- A. VOC Emissions: Products have been selected for this Project with respect to their emissions of Volatile Organic Compounds, in order to limit concentrations of VOC's in occupied spaces to levels below the Reference Established Limits established by the State of California.
1. Maximum allowable concentrations of VOC's include the following:
 - a. Total VOC's (TVOC):
 - b. Formaldehyde: $3 \mu\text{g}/\text{m}^3$
 - c. Naphthalene: $9 \mu\text{g}/\text{m}^3$
 - d. Styrene: $300 \mu\text{g}/\text{m}^3$
 - e. Isocyanurates:
 - f. Diesel Exhaust: $5 \mu\text{g}/\text{m}^3$
 2. Substitutions for any specified VOC-containing product specified will be considered with the condition that acceptable VOC-emission data are available for the proposed product,

or the Contractor arranges to have that product tested for VOC emissions by an independent laboratory.

- B. Airborne Dust: Dust partitions, site dust control measures and other construction practices shall be maintained to prevent airborne dust from leaving the site or accumulating in the building interior.
- C. Moisture: Weather protection, scheduling of the Work, restoration drying techniques using dessicant drying, dehumidification and other construction practices shall be used to maintain the schedule and to prevent construction materials from reaching moisture levels that will support the growth of mold, bacteria and other biological contaminants.
 - 1. Maximum Equivalent Moisture Content (EMC) of substrates installed wet or wetted during the construction process such as concrete, and concrete block shall be measured before application of mold-sensitive finishes. Installation of the following products shall not proceed until the relative humidity in the substrate does not exceed 70 percent relative Humidity (RH) as measured using ASTM F 2170, or in accordance with the manufacturer's written limitations, whichever is lower:
 - a. Non-preservative-treated wood products
 - b. Gypsum wallboard
 - c. Carpet
 - d. Acoustical ceiling tile
 - e. Fabric-covered acoustical panels and tackboards
 - f. Fixed upholstered seating
 - 2. Wood-based finish products such as flooring, architectural woodwork, casework, and other items shall additionally follow the environmental temperature and RH criteria limits established within their respective sections.

1.7 SUBMITTALS

- A. General: Prepare submittals for the Work of this Section according to the procedures outlined in Section 013300 – Submittals, modified as required herein. These submittals will be considered informational submittals.
- B. For each material that contains VOC's, submit to the Architect five copies of an IAQ Submittal package containing the following information for record purposes. This package shall be submitted separately from the submittals required elsewhere for product review:
 - 1. Description of use of product, including estimated area of exposed surface.
 - 2. Product data.
 - 3. VOC data where applicable:
 - a. Fluid materials: Indicate content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
 - b. Solid materials: Provide VOC emission rates.
 - 4. Material Safety Data Sheet.
- C. For construction procedures required to protect Indoor Air Quality, submit the following information for record purposes:
 - 1. Construction Indoor Air Quality Management Plan.
 - 2. Product data for filtration media used during construction and installed at Substantial Completion, highlighting MERV and other performance data.

3. Construction Documentation: Six photographs at three different occasions during construction along with a brief description for each photo of the SMACNA approach employed, including the following:
 - a. Construction areas in occupied buildings that were isolated from adjacent non-construction areas using temporary walls, plastic sheeting, or other vapor retarding barriers.
 - b. Construction areas that were maintained at a negative air pressure to surrounding construction areas.
 - c. Recirculating air ducts that were temporarily capped and sealed (appropriate filters may be used if nuisance particulates are the only contaminant of concern).
 - d. Supply air systems that were operated with filters in place.
 - e. Protection of on-site stored or installed absorptive materials.
 4. Construction Documentation: Six photographs at three different occasions during construction along with a brief description for each photo of the SMACNA approach to duct cleanliness. Show that procedures are being followed to achieve Advanced levels of cleanliness in accordance with SMACNA's "Duct Cleanliness for New Construction Guidelines." Pictures shall illustrate some or all of the following:
 - a. Ductwork is sealed when transported to the construction site.
 - b. Ductwork is stored in clean, dry conditions and kept sealed while stored.
 - c. Contractor wipes down interior surfaces of ductwork immediately prior to installation to remove dust.
 - d. Contractor seals open ends on completed ductwork and overnight work-in-progress.
 - e. During installation, contractor protects ductwork waiting to be installed with surface wrapping.
 5. Construction Documentation: Six photographs, taken at various times during construction, with a brief description of each photo, showing the techniques for protecting building materials (especially gypsum wallboard, wood, porous insulation, paper, and fabric) from mold and moisture damage (e.g., show spacers, show covered materials, show materials stored in protected areas).
 6. Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
- D. Evidence of testing of each substrate to receive mold-sensitive finishes in accordance with ASTM F2170.
- E. The Contractor's schedule shall include a period for Flush-out procedures as specified herein.

1.8 QUALITY ASSURANCE

- A. Construction IAQ Management Plan: The General Contractor shall prepare and implement a plan that complies with SMACNA Guidelines, to address the following issues and other IAQ issues as requested by the Owner:
1. Protection of ventilation system components during construction.
 2. Measures designed to limit the presence of VOC's, dust and other contaminants during construction.
 3. Procedures for depressurizing work areas.
 4. Procedures for drying out construction moisture
 5. Procedures for drying out or otherwise dealing with unanticipated entry of water into new

- or existing construction.
 - 6. Cleanup of contaminated components during construction and after construction is complete.
 - 7. Provision of temporary ventilation and filters as required during construction.
 - 8. Procedures for improved housekeeping
 - 9. Scheduling of construction activities to comply with IAQ requirements of this Section.
 - 10. Plan shall address the method of communication between construction team and building occupants regarding complaints, concerns and predicted changes to IAQ.
- B. Maintain in the Contractor's office a complete and up-to-date notebook of MSDS for all products on-site containing VOC's. Upon the request of the Owner, make the notebook available for review.
- C. Pre-testing of construction products to determine VOC emissions:
- 1. Testing shall conform to the provisions of ASTM D5116-97.
 - 2. The Contractor shall provide pre-testing for the following:
 - a. Product substitutions proposed by the Contractor.

PART 2 - PRODUCTS

2.1 PRODUCTS

- A. Throughout the Work, use products, materials which contribute the minimum practicable dust, odors and contaminants to the indoor environment.
- B. Products containing Volatile Organic Compounds (VOC's):
- 1. Comply with the following criteria for VOC limits for the following field-applied products.
 - a. Adhesives: Refer to Technical Sections which include adhesives, including but not limited to those in Divisions 6 and 9, for specific requirements.
 - b. Sealants: Refer to Section 079200 – JOINT SEALANTS, and other Technical Sections requiring sealants, for specific requirements.
 - c. Paints and Coatings: Refer to Section 099000 – PAINTING AND COATING, for specific requirements.
 - 2. No urea formaldehyde-containing products will be permitted for use in this Project.
 - a. Wood and agrifiber products: Refer to Sections in Division 6 and 12 for products.
 - b. Insulation: Refer to Section 072100 – THERMAL INSULATION, for products.
 - 3. Where VOC limits are not otherwise specified, use products with maximum VOC content of 7% by volume.
 - 4. Comply with requirements of the specifications for all items containing VOC's.
 - 5. All materials containing VOC's shall be installed no less than fourteen days prior to Owner's occupancy of the building.
- C. Indoor Chemical and Pollutant Source Control:
- 1. Provide temporary walk-off mats to reduce entry of dust, moisture and other contaminants into the building during construction.
 - 2. Refer to Section 124810 – ENTRANCE FLOOR MATS AND FRAMES, for permanent floor grilles to be installed at building entrances. These floor grilles shall be protected

from dust, moisture and other contaminants until Substantial Completion.

- D. Mechanical Systems and Controls: Refer to Technical Sections in Division 21, 22, 23 and 26 for mechanical and electrical provisions for maintaining Indoor Air Quality.

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES FOR PROTECTING INDOOR AIR QUALITY

- A. General: Provide physical barriers, ventilation and other controls as specified to reduce potential for odors, dust, and fumes from affecting present and future occupants of the building, and to meet performance criteria specified herein.
- B. Material Transport and Storage:
1. Store construction materials, including ductwork, in clean, dry areas protected from moisture and dust. Refer to Division 2 through 50 Sections for additional on-site storage requirements for individual materials and equipment.
 2. No storage of construction materials or debris will be permitted within mechanical rooms.
 3. Adsorptive materials shall be protected throughout storage at the site in their original wrapping materials.
 4. Keep waste materials that can release dust or odors covered and sealed when on site, and dispose of them promptly.
- C. Installation Sequence: Schedule material installation and construction activities so as to avoid adsorption of VOC's and dust into adsorptive materials.
1. Provide protective cover for adsorptive materials that will be subjected to VOC off-gassing and dust.
 - a. Wrap adsorptive materials in polyethylene or other impermeable material and seal edges with tape.
 - b. Refer to SMACNA Guidelines for minimum requirements.
 - c. Protective cover is required for uninstalled materials stored in the construction area, as well as for installed materials.
 2. Containers of VOC-containing fluids shall be kept tightly sealed. When not in use, such containers shall be stored in a location remote from adsorptive materials or occupied areas.
 3. Apply all wet materials such as paints, coatings and products installed with adhesives, allowing them time to offgas before applying adsorptive or "sink" type products such as.
 - a. Acoustical ceiling tiles
 - b. Carpet
 - c. Fabric materials, upholstered products or fabric-wrapped panels for use as tack-boards or acoustical purposes.
 4. Permit carpeting to offgas for 48 hours at the plant prior to wrapping in plastic wrappings. Otherwise, before installation, open up carpet rolls and spread carpet out in an offsite location and ventilate in an area protected from weather, sources of moisture or other VOC's.
- D. Regular Cleaning during Construction: Refer to Section 011400 – Work Restrictions, for

cleaning provisions. The intent of these documents is to prevent accumulation of contaminant-containing dirt and dust within the building during construction.

1. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
2. Use cleaning methods that minimize airborne dust. Recommended methods include:
 - a. Immediate removal of spills, excess applications of cleaning products and accumulated water.
 - b. Increased frequency of cleaning during construction, to maintain surfaces free of dust accumulation.
 - c. Use of wetting agents and sweeping compounds, and of efficient dust collection equipment such as damp mops and HEPA filtered vacuum cleaners.
 - d. Refer to SMACNA Guidelines for additional cleaning recommendations.

E. Protection from VOC's from Asphalt- and Solvent-Containing Materials:

1. Sealing of air intakes or ventilation required to prevent waterproofing-generated VOC's from entering HVAC system or occupied areas will be performed under Section 079200 – Joint Sealants.
2. Sealing of air intakes to prevent roofing-generated VOC's from asphalt or adhesives from entering HVAC system shall be performed under Division 07 – Roofing Sections.

3.2 MIXING OF MULTI-COMPONENT PRODUCTS

A. General: Fluid-applied products furnished in two or more components shall be mixed thoroughly, in precise proportions so that an excess of one component will not remain uncured. The requirements of this section apply to all fluid-applied multi-component products, including but not limited to the following:

1. Multi-component adhesives.
2. Multi-component waterproofing and sealant products.
3. Multi-component paints and coatings
4. Multi-component fluid-applied floorings

B. Requirements:

1. All multi-component mixtures shall be brought to the Project Site in factory-sealed and pre-measured containers with precise quantities required for proportional mixing. No bulk materials will be permitted on-site if not packaged in this manner.
2. Mix components in strict accordance with manufacturer's written instructions regarding quantities, mixing method and other conditions.
3. Each container of each component shall be completely mixed with the entire contents of a corresponding container of the second component.
 - a. No field mixing of partial quantities will be permitted.
 - b. Properly dispose of mixed components remaining unused at the end of a workday.

3.3 CONTROL OF COMBUSTION PRODUCTS

A. General: Minimize the use of fuel-burning equipment inside and near the building. Where fuel-burning engines are necessary, cycle off equipment when not in use.

- B. Vehicle Exhaust: No vehicles shall be left idling near temporary or permanent air intakes. Motorized vehicles used within the building shall be electrically powered.
- C. Power Equipment: No internal combustion engines shall be operated within the building. Location of engines outside the building shall be remote from permanent air intakes and operable windows of occupied spaces.
- D. Exhaust of Temporary Heating Equipment:
 - 1. No temporary heating equipment that burns kerosene or other liquid fuel will be permitted within the building.
 - 2. Temporary equipment that produces heat by combustion of fuel shall be installed with provisions to ventilate combustion gases to the exterior of the building.
- E. Welding: Welding operations shall be properly ventilated.
- F. Smoking: No smoking will be permitted within the construction site or adjacent areas at any time.

3.4 DUST CONTROL

- A. General: The following provisions do not supersede specific requirements for methods of construction or applicable general conditions set forth elsewhere in the Contract with regard to performance obligations of the Contractor.
 - 1. Maintain the construction site, stockpiles, access, detour, and haul roads, staging and parking area used for the Work, free of dust that would cause a hazard or a nuisance to those at the site or adjacent sites. Refer to Division 31 – EARTHWORK, for additional provisions for control of dust on the site.
 - 2. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and use damp cloths and wetting agents or sweeping compounds to prevent air-borne dust from dispersing into the atmosphere.
 - 3. Cutting of concrete and masonry products shall be performed using wet saw methods.
 - 4. Wet down dry materials and rubbish to lay dust and prevent blowing dust.
 - 5. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
 - 6. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces, including paint, coatings, sealants, caulking, adhesives.
- B. Dust Partitions and Coverings:
 - 1. Furnish, erect, and maintain for the duration of the work period, temporary fire-resistant dust-proof coverings and solid partitions as required to prevent the spread of dust beyond the immediate area where work is being performed.
 - 2. Temporary partitions for dust control shall extend from floor to bottom of structure above, to provide an air-tight barrier. Provide air-tight coverings for openings required for access through partitions.
 - 3. Cover equipment installed within construction area using canvas, polyethylene and tape, or other materials as recommended by manufacturer of equipment for protection from airborne dust and vapors.
 - 4. Refer to Section 015000 – Temporary Facilities and Controls, for additional requirements for temporary partitions and related protective measures.

- C. Prevent dust and odors from entering the new HVAC system. Confirm that the HVAC Sub-contractor has sealed all diffusers, return side ductwork and equipment within the Work Area so as to prevent dust from entering. For further requirements, refer to SMACNA Guidelines and DIVISION 23 – Heating, Ventilating and Air Conditioning.
- D. Prevent exterior dust and odors from entering interior space after building is enclosed. Whenever possible, seal window units with plastic as recommended in SMACNA Guidelines.

3.5 WATER DAMAGE

- A. General: The General Contractor shall be responsible for protecting the Work from moisture, in order to prevent growth of harmful fungus, mold and other biological activity.
- B. Protection of Existing and New Building Construction:
 - 1. Install weatherproof enclosures to protect the Work from exterior sources of moisture in accordance with Section 015000 – Temporary Facilities and Controls.
 - 2. Remove and replace construction which becomes wet for 24 hours or more, or which shows evidence of biological growth due to the presence of moisture.
- C. Protection of Stored Construction Materials:
 - 1. Take precautions to prevent porous materials such as gypsum board, insulation, ceiling tile, wood and similar products from becoming wet.
 - 2. Refer to Section 015000 – Temporary Facilities and Controls, for materials and installation of weatherproof enclosures.
 - 3. Store materials above ground surfaces and provide spacers between ground and protective covering to allow for ventilation
 - 4. Discard construction material which becomes wet, or which shows evidence of biological growth due to the presence of moisture.
- D. Procedures for drying out wet construction: In the case that an unanticipated event permits the entry of water into new or existing construction, the Contractor shall perform procedures to dry out construction within 24 hours, to a degree that will not support biological growth using restoration drying techniques.
 - 1. Refer to guidelines published by the United States Environmental Protection Agency.
 - 2. Construction that is not adequately dried out, or which shows evidence of biological growth, shall be removed immediately from the construction area and disposed of legally.
 - 3. Wetting by contaminated water and subsequent cleaning and decontamination shall be supervised by a qualified company.

3.6 CLEAN UP

- A. Prior to turning over work area to Owner, conduct final cleaning to remove dust to the minimum practicable level.
- B. Clean ductwork, registers and grilles within the Work Area, and HVAC equipment servicing the Work Area using professional duct cleaning company.
- C. After completion of duct cleaning, vacuum vertical and horizontal surfaces, ledges, trim, tops

of light fixtures and other equipment, and other locations where dust has settled. Utilize HEPA filtered vacuum to capture fine dust.

- D. Vacuum all carpeted and fabric-covered surfaces with a high-efficiency particulate arrestor (HEPA) vacuum prior to Substantial Completion.
- E. Do not use solvent-based cleaners in final cleaning of Work Area, unless cleaning occurs at least 14 days prior to Owner's scheduled Active Use of the area.
- F. Coils, air filters and fans in HVAC system shall be cleaned prior to final testing and balancing. Refer to Division 23 – HVAC, for requirements.

3.7 SCHEDULED FLUSHOUT PROCEDURES AND REQUIREMENTS

A. General:

- 1. Schedule Building Flush-Out prior to testing and balancing of mechanical systems, as outlined in Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
- 2. No mechanical system start-up will be permitted until application of major finishes, installation of casework and final cleanup is complete.
- 3. Develop and implement an Indoor Air Quality (IAQ) Management Plan for the pre-occupancy phase in accordance with flush-out procedures and requirements referenced in this section.

B. Building Flush-Out: Refer to Division 23 Sections for requirements for filters, static pressure sensors, start-up and operation of mechanical systems.

C. Procedure: Flush out each space once all major finish materials have been installed on floors, walls, and ceilings. This includes all casework. At that time, each space shall be flushed out separately and occupied once 3,500 ft³ of outdoor air per ft² of floor area of the space has been delivered. The space may then be occupied provided that it is ventilated at a rate of 0.30 cfm/ft² of outside air or the design minimum outside air rate, whichever is greater, a minimum of three hours prior to occupancy and during occupancy, until the total of 14,000 ft³/ft² of outside air has been delivered to the space.

D. Exterior Conditions for Flush-Out:

- 1. Remove potential sources of pollution from proximity to air intakes. Pollutant sources include but are not limited to: waste materials, temporary fuel-burning equipment, vehicles, dust-producing activities.
- 2. Control dust on the building site by spraying exposed soil with water and encouraging growth of permanent grass and other plant materials.
- 3. If unavoidable pollutant-generating activities occur outside the building during the flush-out period, seal building as recommended in SMACNA Guidelines, and discontinue flush-out until such activities cease.

E. Equipment Requirements During Flush-Out Period:

- 1. Temporary MERV 10 filters shall be in place before HVAC system start-up.
- 2. Windows shall be securely closed.
- 3. Disable carbon dioxide monitors.
- 4. Maintain normal room temperature.
- 5. Monitor filter pressure drop for each HVAC unit that contains filters, and replace filters if

needed due to accumulation of particulate matter before the end of the period.

- F. Replace temporary filters with new MERV 13 filters at completion of building flush-out – refer to Division 23 specifications for filter requirements.
- G. Post Flush Out Report: Provide a narrative including the following information:
 - The project's specific flushout procedures.
 - Flush-out schedule, start and finish dates.
 - Zone description of defined areas for flushout.
 - List of air handlers within each zone.
 - Filter media used during and after completion of flushout. (Reference Division 230000 specifications).
 - Flushout period calculations.

3.8 INDOOR AIR QUALITY FIELD TESTING

- A. Indoor Air Quality Testing, General:
 1. The Owner reserves the right to conduct indoor air quality testing before, during and after construction, in order to quantify the effects of the Contractor's Indoor Air Quality Plan and verify that the Indoor Air Quality provisions of the Contract Documents are being met.
 2. The Contractor shall cooperate with the Owner in scheduling the testing and providing access to the site.

END OF SECTION

SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Commissioning is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meet defined objectives and criteria. The Commissioning process begins at project inception (during the pre-design phase) and continues through the life of the facility. The commissioning process includes specific tasks to be conducted during each phase in order to verify that design, construction, and training meets the owner's project requirements.
- B. The Goals of the Commissioning Process are to:
 - 1. Verify that applicable equipment and systems are installed according to the contract documents, manufacturer's recommendations, and industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - 2. Verify and document proper performance of equipment and systems.
 - 3. Verify that O&M documentation left on site is complete.
 - 4. Verify that the owner's operating personnel are adequately trained.
- C. In addition to the scope of work described above, the Cx process will include all work required to satisfy the MA-CHPS project requirements. Specifically EA Prerequisite 2, Commissioning will be provided.
- D. The commissioning process does not take away from or reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions, Division 01, and other trade specific specification sections shall apply to this section.
- B. Owner's Project Requirements and Basis of Design documents are included by reference for information only.
- C. ASHRAE Guideline 0-2005, The Commissioning Process

1.03 SUMMARY

- A. This section includes general requirements that apply to the implementation of the commissioning process without regard to specific systems, assemblies, and components.
- B. Related sections include the following:
 - 1. Section 013300 Submittal Procedures
 - 2. Section 017823 Operation and Maintenance Data
 - 3. Section 017900 Demonstration and Training
 - 4. Section 070800 Commissioning of Building Assemblies
 - 5. Section 210800 Commissioning of Fire Suppression
 - 6. Section 220800 Commissioning of Plumbing Systems
 - 7. Section 230800 Commissioning of HVAC Systems

8. Section 260800 Commissioning of Electrical Systems
9. Section 270800 Commissioning of Communications
10. Section 280800 Commissioning of Electronic Safety and Security
11. Division 21 Fire Suppression
12. Division 22 Plumbing
13. Division 23 Heating Ventilating and Air Conditioning
14. Division 26 Electrical
15. Division 28 Electronic Safety and Security

1.04 DEFINITIONS

- A. Acceptance - A formal action, taken by a person with appropriate provider (which may or may not be contractually defined) to declare that some aspect of the project meets defined requirements, thus permitting subsequent activities to proceed.
- B. Approval - Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the contract documents.
- C. Basis of Design - A document that records the concepts, calculations, decisions, and product selections used to meet the owner's project requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- D. Checklists, Construction Checklists, Installation Checklists, or Pre-Functional Checklists - Checklists that are developed by the CxA and completed by the Construction Team during all phases of the construction process to verify that materials, equipment, assemblies, and systems are installed in accordance with the Contract Documents.
- E. Commissioning Authority or Agent (CxA) - The entity identified by the owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process.
- F. Commissioning Plan (CxP) - A document developed by the CxA that outlines the organization, schedule, roles and responsibilities, and documentation requirements of the Commissioning Process. The CxP is initially developed in the design phase and updated throughout the construction and closeout process.
- G. Commissioning Process - A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.
- H. Commissioning Team - The individuals who through coordinated actions are responsible for implementing the commissioning process.
- I. Data logging -The monitoring and recording of flows, currents, status, pressures, etc., of equipment using stand-alone data recorders separate from the control system or the trending capabilities of control systems.
- J. Deferred Performance Tests (DPTs) - Performance tests that are performed, at the discretion of the CxA, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design, or other site conditions that disallow the test from being performed.
- K. Deficiency, Non-Compliance, Non-Conformance - A condition in the installation or function of a component, piece of equipment, or system that is not in compliance with the contract documents.

- L. Factory Testing - Testing of equipment on-site or at the factory, by factory personnel, with or without an owner's representative present.
 - M. Issues Log - A formal and ongoing record of problems or concerns – and their resolution – that have been raised by members of the commissioning team during the course of the commissioning process.
 - N. Nominal Group Technique - A formal, structured brainstorming process used to obtain the maximum possible ranked input from a variety of viewpoints in a short period of time. The typical approach is a workshop session where a question is presented, the attendees each record their responses on a piece of paper, the individual responses are recorded on a flip chart without discussion in a round robin fashion, all of the responses are discussed, and the participants rank their top five responses.
 - O. Owner's Project Requirements - A written document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. This is also referred to as the Project Intent or Design Intent.
 - P. Quality Based Sampling - A process for evaluating a sub-set (sample) of the total population. The sample is based upon a known or estimated probability distribution of expected values; an assumed statistical distribution based upon data from a similar product, assembly, or system; or a random sampling that has scientific statistical basis.
 - Q. Seasonal Performance Tests - Performance tests that are deferred until the system(s) will experience conditions closer to their design conditions based on weather conditions.
 - R. Startup - The initial starting or activating of dynamic equipment, including completing construction checklists.
 - S. Systems Manual - A system-focused composite document that includes the operation manual, maintenance manual, and additional information of use to the owner during the occupancy and operations phase.
 - T. Functional Performance Test (FPT) - A protocol written by the CxA that defines methods, personnel, and expectations for tests conducted on components, equipment, assemblies, systems, and interfaces among systems. Performance testing includes the dynamic functions and operations of equipment and systems using manual or monitoring methods under various levels of operation. Systems are tested under various modes, such as during low cooling loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to respond as the sequences state.
 - U. Training Plan or Instruction Program - A written document that details the expectations, schedule, and deliverables related to the training of project operating and maintenance personnel, users, and occupants.
 - V. Verification - The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.
 - W. Trending – The monitoring, by a building management system or other electronic data gathering equipment, and analyzing of the data gathered over a period of time.
- 1.05 COORDINATION
- A. Coordination of the Cx process is the responsibility of all Cx Team members.

- B. The CxA coordinates the commissioning activities through the construction manager or general contractor. All members shall work together to fulfill their contracted responsibilities and meet the objectives of the contract documents.
- C. The CxA, through the Owner or CM, will provide sufficient notice to the contractor for scheduling commissioning activities with respect to the Owner's participation. The contractor will integrate all commissioning activities into the overall project schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

1.06 REMOBILIZATION AND RETESTING FEES

- A. In general, CxA testing will include one test of each equipment and system and one retest to verify that any deficiencies have been corrected. The cost of any additional testing will be deducted from the Contractor's final payment by the Owner.
- B. In the event that testing is scheduled in advance with the Contractor and testing is unable to be performed through no fault of the Owner and the CxA is not notified within 48 hours, the cost of the travel and time will be deducted from the contractor's final payment by the Owner.

1.07 COMMISSIONING PLAN

The CxA will update the Commissioning Plan, originally developed in the Design Phase, to incorporate construction phase activities. Cx activities and milestones shall be incorporated into the project schedule by CM. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

- A. Commissioning during construction begins with an initial commissioning meeting conducted by the CxA where the commissioning process is reviewed with the project commissioning team members. This meeting shall be scheduled by the CM within 30 days of the award of contracts related to commissioned systems and equipment.
- B. Additional meetings will be required throughout construction, scheduled by the CxA, through the owner or CM, with necessary parties attending to plan, scope, coordinate, schedule future activities and resolve problems. In general, the frequency of these meetings is as follows: monthly during the early construction process, bi-weekly during the rough-in process, and weekly during the testing process.
- C. The CxA reviews submittals for all commissioned equipment and systems parallel with the Design Team for compliance with the OPR.
- D. The construction checklists, developed by the CxA, are to be completed by the contractor (or its subcontractors), before and during the startup process and verified by the CxA.
- E. The CxA witnesses selected assembly mock-ups and equipment and system start-up.
- F. The CxA develops equipment and system functional performance test (FPT) procedures. The FPT's are executed by the contractor and witnessed and documented by the CxA.
- G. The CxA reviews the O&M documentation for completeness.
- H. The CxA coordinates the training plan provided by the contractor.
- I. Deferred performance testing will be conducted as required.

1.08 COMMISSIONING TEAM

- A. Members appointed by Contractor(s): Individuals, each having authority to act on behalf of the

entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of each contractor, including project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members appointed by Owner:

1. CxA - An entity identified by the owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility Users and Operation and Maintenance personnel.
3. Architect and engineering design professionals.

1.09 RESPONSIBILITIES

Understanding and defining the roles of each participant is vital to the success of the Commissioning Process. This provides an outline of the responsibilities of each participant in the Commissioning Process. These responsibilities are typically formalized in the contracts between the Owner and the various parties and this section is not intended to supersede or negate any contracted relationships.

A. Owner (or Designated Representative):

1. Include the design professionals' Commissioning related responsibilities and scope of work in the design request for proposal and contract.
2. Oversee the development of the Owner's Project Requirements and approve any changes
3. Designates a representative, ideally from the building's operations and maintenance team, to participate in the Commissioning Process including
 - Design Phase coordination meetings
 - Construction Phase coordination meetings
 - Informal owner-training as equipment is installed and started
 - Maintenance orientation and inspections
 - System testing and verification meetings
 - Functional procedure review meetings before testing of systems
 - Training sessions
 - Verification demonstrations
 - Systems and assemblies tests
 - Final review at acceptance meeting
4. Review and approve any changes made to the Owner's Project Requirements
5. Review and approve the Construction Documents
6. Videotape training sessions and construction progress
7. Review, comment on, and accept the Commissioning Authority's progress and final reports

B. Commissioning Authority (CxA):

The Commissioning Authority is responsible to verify that the Owner's Project Requirements for the project are satisfactorily achieved. The CxA is comprised of building commissioning experts who maintain a broad understanding of all aspects of building construction, maintenance, and operations. Specific tasks performed by the CxA include:

Design Phase

1. Assemble a commissioning team, hold a scoping meeting and identify responsibilities.

2. Develop a draft design-phase commissioning plan.
3. Attend commissioning meetings as needed with project coordinator and design team.
4. Review the Owner Objective documentation (design intent) for clarity and completeness.
5. Coordinate the commissioning work during design.
6. Develop and update the design phase commissioning plan.
7. Perform focused review of the design, drawings and specifications at various stages of development (during design development and contract document phases) as described in Exhibit 1 of the RFP.
8. Direct and Review the development and maintenance of Design Record documentation by design team members (Design Intent, Design Narratives, Basis of Design).
9. Develop a draft construction phase commissioning plan using an Owner-approved outline.
10. Develop full commissioning specifications for all commissioned equipment. Coordinate with and integrate into the specifications of the architect and engineers. The specifications will be consistent in content, rigor and format to the referenced standards.
11. The commissioning specification will include:
12. A detailed description of the responsibilities of all parties.
13. Details of the commissioning process.
14. Reporting and documentation requirements, including formats; alerts to coordination issues, deficiency resolution; construction checklist and start up requirement.
15. The functional testing process.
16. Specific functional test requirements, including testing conditions and acceptance criteria for each piece of equipment being commissioned.
17. Coordinate control integration meetings where the owner, electrical engineers, mechanical engineers and CA discuss integration issues between equipment, systems and disciplines to ensure that integration issues and responsibilities are clearly described in the specifications.
18. Review documents and responses from A/E to ensure that all previous comments have been addressed by the appropriate project number.

Bid Phase

1. Attend a pre-bid meeting to answer commissioning related questions.

Construction Phase

1. Perform the tasks and functions to be incorporated in the specifications ascribed to the CA.
2. Coordinate and direct the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties. Frequently updated timelines and schedules and technical expertise.
3. Coordinate the commissioning work, with the contractor, architect and owner's representatives to ensure that commissioning activities are being scheduled into the master schedule.
4. Revise the construction phase commissioning plan developed during the design phase as required to include refined scope and schedule.
5. Plan and conduct commissioning meetings and distribute minutes.
6. Request and review information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures. Before startup, gather and review current control sequence and interlocks. Work with the architect so that the CA/A/E comments are combined into one review submitted to the contractor.

7. Review coordination drawings to ensure that trades are making a reasonable effort to coordinate work. Coordinate submittal review with the architect so that the CA/A/E comments are combined into one review submitted to the contractor.
8. Write and distribute construction checklists for commissioned equipment.
9. Develop an enhanced start-up and initial systems checkout plan with contractors for selected equipment.
10. Perform site visits to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
11. Witness HVAC piping pressure test and flushing to be confident that proper procedures were followed in accordance with specifications. Include testing documentation in the commissioning record.
12. Witness any ductwork testing and cleaning sufficient to be confident that proper procedures were followed in accordance with specifications. Include documentation in the Commissioning Record.
13. Provide construction checklists for equipment/systems within the scope of work to the contractors.
14. Document construction checklist completion by reviewing completed checklists and by site observation.
15. Document system startup by reviewing start-up reports and by selected site observations.
16. Approve air and water systems balancing by spot testing and by reviewing completed reports and by selected site observation. Coordinate submittal review with the architect so that the CA/A/E comments are combined into one review submitted to the contractor.
17. With assistance and review from the installing contractor, CA will write functional performance test procedures for equipment and systems. This will include manual functional testing, energy management control system trending and may include stand alone data-logging monitoring. Submit to owner for review and approval if required.
18. Analyze functional performance trend logs and monitoring data to verify performance.
19. Coordinate, witness and document manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved. The functional testing shall include operating the systems and components through each of the written sequences of operation, and other significant modes and miscellaneous alarms, power failure, security alarm when impacted and interlocks with other systems or equipment. Sensors and actuator shall be calibrated during construction check listing by the installing contractors, and spot-checked by the CxA during functional testing.
20. Tests on respective HVAC equipment shall be executed, if possible, during both the heating and cooling season. However, some overwriting of control values to simulate conditions shall be allowed. Functional testing shall be done using conventional manual methods, control system trend logs, and read-outs or stand-alone data loggers, to provide a high level of confidence in proper system function, as deemed appropriate by the CxA and the Owner.
21. Prepare test plans for, assist with execution of, and document tests of commissioned equipment overseen by regulatory authorities and ensure that such tests meet the testing rigor desired by the Owner.
22. Maintain a master issues log and a separate record of functional testing. Report all issues as they occur directly to the owner's representative and the architect. Provide directly to the owners representative and the architect written progress reports and test results with recommended actions.
23. Review equipment warranties to ensure that the Owner's responsibilities are clearly

defined.

24. Oversee and approve the training of the Owner's operating personnel.
25. Review and approve the preparation of the O&M manuals for commissioned equipment. Coordinate submittal review with the architect so that the CA/A/E comments are combined into one review submitted to the contractor.
26. Compile a commissioning Record, which shall include:
27. A brief summary report that includes a list of participants and roles, brief building description, overview of commissioning and testing scope, and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the CA regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas:
 - Equipment meeting the equipment specifications.
 - Equipment installation.
 - Functional performance and efficiency.
 - Equipment documentation.
 - Operator training.
28. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.
29. Also included in the Commissioning Record shall be the issues log, commissioning plan, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests, and trend log analysis.
30. Provide 2 paper copies and one electronic copy of the Commissioning Record to the Owner.
31. Comply with the requirements of LEEDTM 2009 Edition 2.2 EA prerequisite 1, Fundamental Building Systems Commissioning and EA credit 3, Enhanced Commissioning. Complete all paperwork required for LEEDTM submittal of these points, including an audit if required.

Warranty Period

1. Coordinate and supervise required opposite season or deferred testing and deficiency corrections and provide the final testing documentation for the Commissioning Record and O&M manuals.
2. Return to the site at 10 months warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have with operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals.
3. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports and documents and requests for services to remedy outstanding problems. The CxA is not responsible for correcting deficiencies.

C. Design Team

The primary role of the Design Team is to translate the Owner's Project Requirements into a complete design. Relative to commissioning, the design team's responsibilities vary depending on the specific project and contract, but may include:

1. Participate in the development and documentation of the initial Owner's Project Requirements.
2. Document revisions to the Owner's Project Requirements as approved by the Owner
3. Document the Basis of Design.

4. Integrate the Commissioning Process requirements provided by CxA in the Contract Documents.
5. Respond to Commissioning Team design review comments.
6. Adequately detail the Operations and Maintenance of the systems and assemblies in Contract Documents.
7. Review and incorporate the CxA's comments from submittal reviews.
8. Participate in the initial Operation and Maintenance personnel training sessions. Include a presentation of the project's Basis of Design and descriptions of the associates systems.
9. Review functional test procedures.
10. Review the CxA's reports and logs and comment as appropriate.
11. Review and comment on the final Cx Report.

D. Construction Manager

The Construction Manager provides management, technical, and administrative expertise during the Construction phase to ensure the building Owner's goals relating to schedule and quality are met. The Construction Manager's responsibilities related to the Commissioning Process typically include:

1. Include any costs for Commissioning Process activities in the contract price.
2. Include Commissioning Process requirements and activities in all contractors' contracts.
3. Ensure necessary accessibility to all equipment to allow for proper operation and maintenance of the building.
4. Provide individuals with the required background and authority to implement the Commissioning Process activities as outlined in the Contract Documents.
5. Issue a statement at the end of the project certifying that all work has been completed in accordance with the Contract Documents and the facility is operational.
6. Respond to Commissioning Process reports and correct deficiencies identified during installation verification or functional testing.
7. Review and comment on the final Cx Report.

E. Contractors

Depending on the nature and the size of the project, many different contractors may be involved in the Commissioning Process. The various contractors may include the building contractors (general, mechanical and electrical), the testing, adjusting, and balancing contractor, the building automation system contractor and others as required by the contract documents. As a member of the Commissioning Team, the responsibilities of the various building contractors include:

1. Include any costs for Commissioning Process activities in the contract price.
2. Include Commissioning Process requirements and activities in all subcontracts or equipment purchases.
3. Ensure the cooperation and participation of all subcontractors and manufacturers of equipment or systems to be commissioned.
4. Attend Commissioning Team meetings.
5. Include Cx-related milestones in the construction schedule.
6. Implement the training program as described in the Contract Documents. Coordinate related activities with the CxA.
7. Provide submittals to the Owner, Design Team, and CxA as detailed in the Contract Documents.
8. Notify the CxA when systems and assemblies are ready for installation verification and testing. For repetitive assemblies, notify the CxA upon the completion of the prototype for

a First Piece or Mock-Up review.

9. Demonstrate the performance of assemblies and operate systems as required to fulfill the requirements of the Functional Test Procedures detailed in the Commissioning Plan and the Contract Documents.
10. Complete the Construction Checklists as the work is completed. Provide completed copies to the CxA at regular intervals for verification.
11. Maintain the Project Record Documents in accordance with the requirements of the Contract Documents.

F. Manufacturers

The suppliers of major equipment are required to support the Commissioning Team in the following manner:

1. Provide all information required for the proper Start-up and Operation and Maintenance of the system or assembly in the initial submittal, as detailed in the Contract Documents.
2. Provide the requirements to maintain the warranty in the initial submittal, as detailed in the Contract Documents.
3. Coordinate and provide results of all factory tests required in the Contract Documents.
4. Participate in the training process as detailed in the Contract Documents.
5. Demonstrate operation and performance of equipment and assemblies as detailed in the Contract Documents.

G. Operations and Maintenance Staff

The Operations and Maintenance staff will participate in the Commissioning Process in the following areas:

1. Define Operations and Maintenance related requirements of the building.
2. Participate in design review for O&M impacts.
3. Review maintenance manual, record drawing and documentation requirements developed by the Design Team.
4. Define training program requirements.
5. Participate/witness functional performance testing.
6. Attend contractor and vendor training sessions.

1.10 EQUIPMENT/SYSTEMS TO BE COMMISSIONED

- A. The following equipment/systems will be commissioned in this project:

Building Envelope

Exterior walls
Exterior windows
Exterior doors
Louvers and vents
Grilles and sunscreens
Infrared scan of envelope

Roofing

Roof systems, including parapet.
Roof openings, including skylights, pipe
chases, ducts, etc.
Infrared scan of roof

HVAC Systems

Boilers
Chillers
Hot Water System
Chilled Water System
Air handling systems
Rooftop units
Fan Powered VAV's
VAV's
Radiant Ceiling Panels
Unit ventilators
Cabinet unit heaters
Fan coil units
Unit heaters
Finned tube radiation
Convectors
Exhaust fans
Combustion air units
Split system AC
Make-up air units
Heat recovery systems
Testing, adjusting and balancing spot check
Building Automation System

Plumbing Systems

Natural gas systems
Backflow preventers
Pressure booster systems
Water heaters
Recirculation pumps
Water closets and sinks
Safety shower/eyewash stations
Mixing valves

Electrical Power Systems

Electrical service and switchgear
Transformers
Motor control centers
Electrical distribution systems
Emergency and standby power systems
including automatic transfer switching
systems
Lighting and lighting control systems
Low voltage systems
Grounding and bonding systems
Interfaces to automated temperature/building
automation control systems

Voice, Data, Video Systems

Cabling
Switches
Servers
Routers
Interfaces
Terminals
Master clock system
Public address systems

Life Safety Systems

Security systems
Fire alarm systems
Fire suppression systems
Fire pump systems
Egress lighting

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required performance testing shall be provided by the contractor for the equipment being tested. This includes,

but is not limited to, two-way radios, meters, and data recorders. Data recorders may be provided by the CxA at the option of the CxA.

- B. Special equipment, tools, and instruments required for testing equipment according to these contract documents shall be included in the contractor's base bid price and shall be turned over to the owner at Project close-out.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration to NIST traceable standards within the past year to an accuracy of 0.5 degree F and a resolution of + or - 0.1 degree F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 OVERVIEW

Through the Construction Phase of the project, it is the responsibility of the CxA to coordinate and direct the Commissioning Process activities in a logical, sequential, and efficient manner using protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties.

3.02 CONDUCT PRE-CONSTRUCTION MEETING

The Pre-Construction Meeting is an opportunity for the CxA to meet with the Construction Team and discuss the general Commissioning Process. It is the ideal time to identify Commissioning Team members, discuss the integration of the Commissioning Process Schedule with the Construction Schedule, review the submittal review requirements, review the inspection and testing process, and develop the formal lines of communication between all parties.

3.03 CONDUCT REGULAR COMMISSIONING MEETINGS

Once the Commissioning Team (Cx Team) has been formed, regular Commissioning Meetings are held. These meetings vary in frequency based upon the activity level at the time, but generally are coordinated to coincide with Construction Meeting days for convenience. At the Commissioning Meetings, past Commissioning Process activities are reviewed, future Commissioning Process activities are planned and coordinated, Commissioning documentation is requested and exchanged, and the Commissioning Schedule is updated and integrated into the Construction Schedule. The CxA will request all documentation necessary to develop the installation checklists, contractor start-up checklists, and the functional performance tests at these meetings and review the draft versions of these documents with the contractors that are responsible for implementing them. The CxA leads these meetings, records the minutes, and distributes the minutes with action items to all Cx Team members.

3.04 CONTRACTOR SUBMITTAL REVIEW

The CxA will review the Contractor submittals coincident with the Design Team and provide comments to the Design Team for inclusion with their review so a single set of review comments can be provided to the Contractors. The reviewed submittals will include all commissioned equipment information and coordination drawings that include commissioned equipment and systems, control drawings and sequences, and interfaces and interlocks between systems. In addition, the CxA will periodically review the final Design Team comments to ensure a quality review process.

3.05 MAINTAIN ISSUES LOGS

Throughout the Construction Process, the CxA will maintain a Commissioning Issues Log. This log will document all Construction Phase issues through a sortable database that identifies the following fields.

- A. The responsible party, either Construction Team member, Design Team member, or Owner
- B. The exact location of the issue (floor and room)
- C. The applicable system component, i.e. lighting, a specific piece of equipment, or a system.
- D. The project impact
- E. A severity
- F. A deficiency code, i.e. craftsmanship, non-compliance, etc.
- G. A reference to the Contract Documents
- H. A detailed description of the issue
- I. A status, i.e. complete, incomplete, accepted, unverifiable
- J. A code indicating whether the issue was identified during installation inspections or functional performance testing.

The issues log will be distributed and reviewed at each Commissioning Meeting and each issue will be tracked by the CxA until it is resolved.

3.06 CONSTRUCTION CHECKLISTS

In general, the Contractors will be responsible for completing documentation related to the installation, start-up, and testing of all commissioned equipment and systems. This documentation will be kept on-site and be completed through the use of paper forms.

A. Delivery Book

The Delivery Book will be maintained in duplicate with one copy on site in the Construction Manager's field office and one copy off-site in the CxA's office. It is the responsibility of the Construction Team to keep the Book updated and provide copies of additions and changes to the CxA at Commissioning Meetings. The Book will initially be provided by the CxA and will include all of the Commissioning Process documentation required for the installation and start-up of commissioned equipment and systems.

B. Installation Checks

The Construction Team will be responsible for completing installation checklists for all commissioned systems and equipment. The checklists will include best practices related to the specific equipment or system, highlights of required installation details from the drawings and specifications, and equipment manufacturer, model number, serial number, and capacity verification information. It is intended that these checklists will be generally limited to a single page per equipment and system. The CxA will use sampling strategies to field verify the proper completion of the checklists with sampling rates determined based upon the success of the verification process, the quantity of each type of equipment, and the relative importance of the equipment's operation related to the overall building operation.

C. Start-up Checks

In order to achieve successful equipment start-ups, the CxA will develop start-up checklists for commissioned equipment and systems. The goal of the checklists are to make sure that equipment and systems are operable at the time of the scheduled start-up, all appropriate parties are in attendance, manufacturer's recommended procedures are followed, and warranties are not voided and equipment damaged by improper start-up procedures. It is intended that these checklists be generally limited to a single page per equipment of system.

3.07 SITE OBSERVATIONS

Periodically throughout the Construction process, the CxA will perform site visits to observe component and systems installations. These visits will be strategically planned to coincide with selected planning and job-site meetings, installation milestones, component and assembly mock-

ups, and equipment and system start-ups. The CxA will use these site visits to verify the proper completion of installation and start-up checklists, witness HVAC pipe and duct cleaning and testing, review and approve the air and water systems balancing by selective testing, and generally track the progress of the construction. A field report will be provided at the conclusion of each visit documenting the tasks accomplished during the visit.

3.08 TRAINING AND O&M REVIEW

Ideally, the Owner's operations and maintenance staff would commence training during the construction phase through a combination of formal and informal training activities. At this time, there are no operations and maintenance staff identified due to the building's eventual ownership structure. Therefore, it is likely that all training will take place after the project is completed. The CxA will review and approve the preparation of the Operations and Maintenance (O&M) manuals for commissioned equipment. This review will be coordinated with the Design Team to provide one submittal review to the Contractor. The CxA will coordinate with the Contractor to have the O&M manuals ready and available for use in the training process.

3.09 TESTING

The performance of the testing of all commissioned equipment and systems is the responsibility of the Contractors. The CxA will develop the functional performance tests with the assistance of the installing contractors, coordinate the testing process, and witness the tests that are performed by the Contractors. In addition, the CxA will prepare plans for, assist with execution of, and document tests of commissioned equipment overseen by regulatory authorities and ensure that such tests meet the rigor desired by the Owner. The CxA will coordinate the retesting of equipment until satisfactory performance is achieved.

The functional performance testing will include operating the systems and components through each of the written sequences of operation, other significant modes and miscellaneous alarms, power failure, and security alarm when impacted by and interlocked with commissioned equipment. Sensors and actuators shall be calibrated during construction check listing by the installing contractors and spot checked by the CxA during functional testing. Tests on HVAC equipment shall be done, if possible, in their proper operating season (cooling in summer, heating in winter). Any equipment that operates in both seasons, such as the heat pumps, should ideally be tested in both seasons. However, if this is not possible, some manipulation of setpoints and control points will be done to simulate the necessary conditions. Functional testing will be done using conventional manual methods, control system trend logs, and stand-alone data loggers as required to provide a high level of confidence in proper system function, as deemed appropriate by the CxA and the Owner. A separate report will be provided that includes all of the issues identified during the testing process.

As a component of the test procedures, the CxA will identify specific system trends to be set up and then analyze the trend and monitoring data as a method of verifying performance.

PART 4 - OCCUPANCY AND OPERATIONS PHASE

4.01 FINAL COMMISSIONING PROCESS REPORT

At the completion of the Commissioning Process, the CxA will provide a final report based on the framework of this Commissioning Plan. An Executive Summary will be included that provides a summary of the participants and their roles, a brief building description, an overview of the commissioning and testing scope, and a general description of testing and verification methods. Included with the summary will be a matrix that provides the disposition of the CxA regarding the adequacy of the commissioned equipment and system in the following five areas: Equipment meeting the equipment specifications, Equipment installation, Functional performance and efficiency, Equipment documentation, and Operator training.

The final report will specifically identify all outstanding non-compliance issues, recommendations for improvement to equipment or operations, future actions required, and recommended changes to the Commissioning Process. In addition, the Report shall include a final issues log with all issues identified through the Commissioning Process, original commissioning plan, progress and field reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests, and trend log analysis.

Two paper copies and one electronic copy of the report will be provided to the Owner.

4.02 SEASONAL TESTING

Any equipment or system that cannot be adequately tested at the time of the initial testing due to seasonal operating issues will be retested in their primary operating season. Whenever possible, systems will be tested under load to verify system capacity and function.

4.03 ONGOING TRAINING

The CxA will oversee and approve the Contractor-provided training of the Owner's operating personnel. The training agendas, attendance logs, and materials will be documented by the CxA and any additional or supplemental training required for the Owner's operating personnel to properly and efficiently operate the building will be provided by the CxA.

4.04 WARRANTY REVIEW

The CxA will return to the site 10 months into the 12 month warranty period and review with facility staff the current building operation and condition of outstanding issues related to the original and seasonal commissioning. Any issues that may come under warranty or under the original construction contract will be identified and the CxA will assist the facility staff in developing reports, documents, and requests for services to remedy outstanding problems. The CxA is not responsible for correcting deficiencies.

4.05 LESSONS LEARNED MEETING

The CxA will coordinate and lead a Lessons Learned meeting with the Owner, the Owner's operating personnel, and representatives of the Design and Construction Teams. Using the Nominal Group Technique, the CxA will develop a consensus of the building operation, the relative success of the project, and recommendations for improvements to this and future projects. These results of this process will be distributed to all participants and added to the O&M manuals.

4.06 MA CHPS DOCUMENTATION

In addition to the reports described above, all paperwork required to complete the requirements of MA-CHPS EA Prerequisite 2, Commissioning will be provided. This includes submittal paperwork and any work required for audits of these points.

END OF SECTION 019113

SECTION 024100

DEMOLITION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

A. Work Included:

1. Demolition and removal of selected portions of buildings and structures and as required for new work. Refer to the Drawings for additional requirements.
2. Demolition and removal of selected site elements and as required for new work. Refer to the Drawings for additional requirements.
3. Salvage of existing items to be reused or turned over to the facility.
4. Removal and legal disposal of demolished materials off site. Except those items specifically designated to be relocated, reused, or turned over to the facility, all existing removed materials, items, trash and debris shall become property of the Contractor and shall be completely removed from the site and legally disposed of at her/his expense. Salvage value belongs to the Contractor. On-site sale of materials is not permitted.
5. Maintenance, watering and care of trees designated to remain by a certified arborist during the construction period.
6. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
7. Scheduling and sequencing operations without interruption to utilities serving occupied areas. If interruption is required, obtain written permission from the utility company and the Owner. Provide temporary services as necessary to serve occupied and usable facilities when permanent utilities must be interrupted, or schedule interruption when the least amount of inconvenience will result.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Division 01 - GENERAL REQUIREMENTS for Temporary Facilities And Controls:
 - a. Maintenance of access, cleaning during construction, dust and noise control.
2. Section 017400 - CLEANING WASTE MANAGEMENT:
 - a. Waste management and recycling.
3. Division 21 - FIRE PROTECTION:
 - a. Disconnecting, capping and otherwise making inactive existing mechanical services in areas where demolition and removal work is required. Mechanical

- tradesmen will disconnect, cap, inactivate and lower to floor such items where required to be removed under Division 21 - FIRE PROTECTION. Removal and storage of such materials shall be then done under this Section 024100 - DEMOLITION.
- b. Disconnect and reinstallation of fire protection equipment temporarily interrupted during construction.
4. Division 22 - PLUMBING:
 - a. Disconnecting, capping and otherwise making inactive existing mechanical services in areas where demolition and removal work is required. Mechanical tradesmen will disconnect, cap, inactivate and lower to floor such items where required to be removed under Division 23 - PLUMBING. Removal and storage of such materials shall be then done under this Section 024100 - DEMOLITION.
 - b. Disconnect and reinstallation of plumbing equipment temporarily interrupted during construction.
 5. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
 - a. Disconnecting, capping and otherwise making inactive existing mechanical services in areas where demolition and removal work is required. Mechanical tradesmen will disconnect, cap, inactivate and lower to floor such items where required to be removed under Division 23 - HEATING, VENTILATING AND AIR CONDITIONING. Removal and storage of such materials shall be then done under this Section 024100 - DEMOLITION.
 - b. Disconnect and reinstallation of HVAC equipment temporarily interrupted during construction.
 6. Division 26 - ELECTRICAL:
 - a. Disconnecting, capping and otherwise making inactive existing electrical services in areas where demolition and removal work is required. Electrical tradesmen will disconnect, cap, inactivate and lower to floor such items where required to be removed under Division 26 - ELECTRICAL. Removal and storage of such materials shall be then done under this Section 024100 - DEMOLITION.
 - b. Disconnect and reinstallation of electrical equipment temporarily interrupted during construction.
 7. Division 31 - EARTHWORK:
 - a. Excavating and removal of existing pavement, sub-surface building and utility structures and lines, appurtenances, and other elements indicated on the Drawings.

1.3 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: Detach items from existing construction and deliver them to the Owner ready for reuse, at a location designated by the Owner. Protect from weather until accepted by Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated. Protect from weather until reinstallation.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain property of the Owner as applicable.

Carefully remove each item or object in a manner to prevent damage and deliver promptly to a location acceptable to the Owner.

1.5 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
1. Detailed sequence of selective demolition and removal work, with early and late starting and finishing dates for each activity. Ensure Owner's on-site operations are uninterrupted if applicable.
 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. Locations of proposed dust- and noise-control temporary partitions and means of egress, including for other occupants affected by selective demolition operations.
 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 7. Means of protection for items to remain and items in path of waste removal from building.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged, and turned over the Owner.
- C. Predemolition Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Comply with Division 01. Submit before Work begins.
- D. Landfill Records: Provide trip tickets (receipts) indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
1. Comply with submittal requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.

1.6 QUALITY ASSURANCE

- A. Examination of Existing Conditions: The Contractor shall examine the Contract Drawings for demolition and removal requirements and provisions for new work. Verify all existing conditions and dimensions before commencing work. The Contractor shall visit the site and examine the existing conditions as he finds them and shall inform herself/himself of the character, extent and type of demolition and removal work to be performed. Submit any questions regarding the extent and character of the demolition and removal work in the manner and within the time period established for receipt of such questions during the bidding period.
- B. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- C. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.
- D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- E. Standards: Comply with ANSI A10.6 and NFPA 241.

- F. Predemolition Conference: Conduct conference at Project site to comply with requirements in Section 011000 - GENERAL REQUIREMENTS, Project Meetings. Review methods and procedures related to selective demolition including, but not limited to, the following:
1. Inspect and discuss condition of construction to be selectively demolished.
 2. Review structural load limitations of existing structure.
 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 5. Review areas where existing construction is to remain and requires protection.

1.7 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.

PART 2 - PRODUCTS (Not Used)

2.1 SALVAGING

- A. Salvaged for Reinstallation: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and reinstalled shall be carefully removed and stored at a location acceptable to the Architect and Owner. Materials to be salvaged include, but are not limited to the following:
1. Brick.
 2. Stone.
 3. Door hardware.
 4. Doors and frames.
- B. Salvaged for Storage: Materials indicated on the Drawings or designated in the field by the Owner to be salvaged and stored shall be carefully removed and delivered to the Owner at locations determined by Owner. Materials to be salvaged include, but are not limited to the following:
1. Brick.
 2. Stone.
 3. Door hardware.
 4. Doors and frames.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- 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 registered in the state that the project is located to survey 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 demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.
 - 1. 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.
- G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Service/System Requirements: 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 and Owner.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.
 - 4. Prior to commencing cutting work in existing surfaces, take all precautionary measures to assure that mechanical and electrical services to the particular area have been made inactive. Coordinate with Fire Protection, Plumbing, HVAC, and Electrical subcontractors. Only licensed tradesmen of that particular trade shall disconnect and cap existing mechanical and electrical items that are to be removed, abandoned and/or relocated.
 - 5. If, during the process of cutting work, existing utility lines are encountered which are not indicated on the Drawings, regardless of their condition, immediately report such items to the Architect. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.

3.3 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 011000 - GENERAL REQUIREMENTS, Temporary Facilities and Controls.
 - 2. Maintain adequate passage to and from all exits at all times. Before any work is done which significantly alters access or egress patterns, consult with the Architect and obtain

approval of code required egress. Under no condition block or interfere with the free flow of people at legally required exits, or in any way alter the required condition of such exits.

- B. 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.
 - 2. Remove temporary shoring, bracing and structural supports when no longer required.
 - 3. Post warning signs and place barricades as applicable during placement and removal of temporary shoring.
- C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area(s).
 - 1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction. Provide temporary barricades as required to limit access to demolition areas.
 - 2. Protect existing site improvements, appurtenances, and landscaping to remain.
- D. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.

3.4 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. Comply with requirements in Section 017400 - CONSTRUCTION WASTE MANAGEMENT.
- B. 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 storage area designated by the Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

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

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.

E. Items for Re-use and Preservation of Existing Surfaces to Remain:

1. The Contractor shall inspect closely each item specifically designated to be relocated, re-used, or turned over to the Owner prior to its removal, and immediately report damages and defects to the Architect and the Owner. The Contractor shall be responsible for any subsequent damage to the same other than latent defects not readily apparent from close inspection, and shall bear responsibility for its repair or same replacement as directed by the Architect, to the satisfaction of the Owner.
2. Unless special surface preparation is specified under other Specification Sections, leave existing surfaces that are to remain in a condition suitable to receive new materials and/or finishes.

3.5 PROTECTION OF PUBLIC AND PROPERTY

- A. Provide all measures required by federal, state and municipal laws, regulations, and ordinances for the protection of surrounding property, the public, workmen, and Owner's employees during all demolition and removal operations. Measures are to be taken, but not limited to installation of sidewalks, sheds, barricades, fences, warning lights and signs, trash chutes and temporary lighting.
- B. Protect all walks, roads, streets, curbs, pavements, trees and plantings, on and off premises, and bear all costs for correcting such damage as directed by the Architect, and to the satisfaction of the Owner.
- C. Demolition shall be performed in such a manner that will insure the safety of adjacent property. Protect adjacent property from damage and protect persons occupying adjacent property from injuries which might occur from falling debris or other cause and so as not to cause interference with the use of other portions of the building, of adjacent buildings or the free access and safe passage to and from the same.
- D. Every precaution shall be taken to protect against movement or settlement of the building, of adjacent buildings, sidewalks, roads, streets, curbs and pavements. Provide and place at the Contractor's own expense, all necessary bracing and shoring in connection with demolition and removal work.

- E. Remove portions of structures with care by using tools and methods that will not transfer heavy shocks to existing and adjacent building structures, both internal and external of the particular work area.
- F. Provide and maintain in proper condition, suitable fire resistive dust barriers around areas where interior demolition and removal work is in progress. Dust barriers shall prevent the dust migration to adjacent areas. Remove dust barriers upon completion of major demolition and removal in the particular work area.

3.6 DISCOVERY OF HAZARDOUS MATERIALS

- A. If hazardous materials, such as chemicals, asbestos-containing materials, or other hazardous materials are discovered during the course of the work, cease work in affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Continue work in other areas.
- B. If unmarked containers are discovered during the course of the work, cease work in the affected area only and immediately notify the Architect and the Owner of such discovery. Do not proceed with work in such areas until instructions are issued by the Architect. Take immediate precautions to prohibit endangering the containers integrity. Continue work in other areas.

3.7 CUTTING

- A. Perform all cutting of existing surfaces in a manner which will ensure a minimal difference between the cut area and new materials when patched. Use extreme care when cutting existing surfaces containing concealed utility lines which are indicated to remain and bear full responsibility for repairing or replacement of all such utilities that are accidentally damaged.
- B. Provide a flush saw cut edge where pavement, curb and concrete removals abut new construction work or existing surfaces to remain undisturbed.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Comply with requirements of Section 017400 - CONSTRUCTION WASTE MANAGEMENT and the following.
 - 1. Do not allow demolished materials to accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Premises shall be left in a clean condition and ready to accept alteration work and new construction.

END OF SECTION

SECTION 033000

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Work Included: The work of this Section consists of all plain and reinforced concrete work as shown on the Drawings and as specified herein, and includes, but is not limited to the following:
 - 1. Furnishing, placing, curing and finishing of all plain and reinforced concrete work for the building and site.
 - 2. Furnishing, erection and removal of formwork and shoring.
 - 3. Furnishing and placing of reinforcing steel and related accessories.
 - 4. Furnishing and installation of bentonite strip waterstops.
 - 5. Setting of anchor bolts and grouting of leveling plates and bearing plates.
 - 6. Coordination with all other trades for location of all pipe sleeves, roof drains, floor drains, duct openings, keys, chases, electrical boxes and conduits, anchors, inserts, fastenings and other devices required by other trades.
 - 7. Hardening and sealing of exposed concrete floors.
 - 8. As-built surveys of concrete floor slab elevations.
 - 9. Leveling of concrete slabs.
- B. Items to be installed only: Install the following items furnished by the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING: Anchor bolts, embedded plates with bolts or anchors, as indicated on the Drawings.
 - 2. Section 079500 - EXPANSION CONTROL: Expansion joint covers, as indicated on the Drawings.
- C. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 - Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.

D. Related Work: Related work shall be performed under the following Sections:

1. Section 042000 - UNIT MASONRY.
2. Section 051200 - STRUCTURAL STEEL FRAMING.
3. Section 051226 – SHEAR CONNECTORS.
4. Section 053100 - STEEL DECKING.
5. Section 055000 – METAL FABRICATIONS.
6. Section 071100 - BITUMINOUS DAMPPROOFING.
7. Section 071610 - CRYSTALLINE WATERPROOFING.
8. Section 072100 - THERMAL INSULATION.
9. Section 079200 - JOINT SEALANTS.
10. Section 079500 - EXPANSION CONTROL.
11. Section 312000 - EARTHWORK.
12. Section 321313 – CONCRETE PAVING

1.3 REFERENCES (LATEST EDITIONS)

- A. ASTM listed standards by the American Society for Testing and Materials.
- B. ACI listed standards by the American Concrete Institute.
- C. CRSI listed standards by the Concrete Reinforcing Steel Institute.
- D. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- E. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.4 SUBMITTALS

- A. Submit complete Shop Drawings, Samples and other Data in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES.
 1. Shop Drawings:
 - a. Construction joint layout: Submit drawings showing proposed construction joint locations for all walls, slabs, slabs on metal deck, beams, etc. Drawings shall be submitted prior to preparation of reinforcement drawings.
 - b. Reinforcement Drawings: Prepare in accordance with ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures" and show following: elevations; dimensions of concrete work with specified

- reinforcement clearances; ledges, brackets, openings, sleeves or other items furnished by other Sections, where interference with reinforcement may occur; bending diagrams; assembly diagrams; splices and laps of reinforcement; temperature and shrinkage reinforcement; construction joint locations and reinforcement; shapes, dimensions, grade designations and details of reinforcement and accessories. Show dowels with concrete work to be placed first. Indicate suitable marks for placing bars.
- c. Formwork Drawings: Schedules of placement; beam and haunch detailing, expansion joint details, construction joints and contraction or control joints with methods of forming; general arrangement, sizes and grades of lumber, panel and tie layouts and alignment. Formwork drawings will be reviewed for general compliance with Contract Documents only. Dimensions, strength of formwork, shoring, bracing, etc. are the sole responsibility of the Contractor. At Architecturally Exposed Concrete areas, show layout of joint patterns and exposed cone recesses at wall ties.
 - d. Except as otherwise noted, approval of Shop Drawings will be for size and arrangement of components. Errors in dimensions shown on Shop Drawings shall be responsibility of Contractor.
 - e. Check and coordinate cast-in-place concrete work with work of other trades before submitting Shop Drawings.
 - f. Submit plans for all levels with M.E.P. penetration sizes and locations for approval prior to submitting reinforcing shop drawings.
 - g. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 – ELECTRONIC RELEASE FORM.
2. Concrete Constituents: Submit a detailed list of concrete materials and corresponding sources, proposed for use in concrete for this project. If conveying concrete by pump is requested by Contractor, related data regarding concrete materials, pumping devices and methods shall be submitted to Architect for approval three weeks before such method is proposed for use. Provide concrete mix data as specified in Paragraph 2.02B.
 3. Methods of Construction: Prior to starting work, submit summary of methods, sequence of construction, and type of equipment proposed for use for performing cast-in-place concrete work. This submission shall not relieve Contractor of his responsibility for providing proper methods, equipment, workmanship and safety precautions.
 4. Samples: Submit samples and/or descriptive literature of materials, products, and methods as noted herein, and as otherwise requested by the Architect: concrete constituents including admixtures; color pigments, form ties and spreaders; accessories for reinforcement; reglets; non-shrink cement grout; inserts; form release agents and waterstops.
 5. Mill Test Certification: Prior to delivery of steel or concrete to job site, submit

certified mill test reports of reinforcing steel and cement, (including names and locations of mills and shops and analyses of chemical and physical properties) properly correlated to concrete to be used in this project. Test reports for reinforcing to be welded shall show that the steel meets AWS weld ability requirements.

6. Concrete Curing and Protection: Submit summary of methods proposed for curing and protection of concrete. When applicable, submittal shall include methods of cold weather protection following the requirements of ACI 306 – Cold Weather Concreting and/or hot weather protection following the requirements of ACI 305 – Hot Weather Concreting.
7. Corrective Work: Submit drawings showing details of any proposed corrective work.
8. Affidavit: Submit, upon request by Architect, manufacturer's and/or supplier's and/or installer's affidavit stating that material or product provided complies with Contract Documents.
9. Sample Panels: Prepare sample panels for exposed, non-colored concrete. Make at least four feet square to show color, texture, form joints, reglet strip, form tie detail, workmanship, and repairing techniques. Use a concrete mix incorporating the proposed cement, aggregates, and admixtures, in the proportions of the design mixes for exposed concrete work. Allow for two preliminary sample panels and one final sample panel. After approval of the final sample panel by the Architect, this panel will be maintained as a standard of reference for color, texture and workmanship for architecturally exposed concrete on the project.
10. Colored concrete mock-up: The Contractor shall allow for up to three colors (from manufacturer standard colors) to be mocked up for the selection of one color to be approved for use on the project. Mock-up panels for colored concrete at the terraces shall be at least six feet square. The Contractor shall allow in his schedule sufficient curing time for the cured color to be reviewed by the Architect (generally about 30 days).

Mock-ups shall be provided for approval by the Architect prior to construction. Once approved, the mock-ups shall serve as the standard for the balance of the work and shall be protected against damage until final approval of the remaining work. The mock-up panels shall be removed at the end of construction of the concrete items and the specified materials be installed in place of the panels.

- B. Provide concrete Mix Data as specified in Paragraph 2.2B.
- C. Provide manufacturer's data for other products.
- D. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Contractor.
- E. The Contractor is responsible for furnishing and installing materials called for in Contract Documents, even though these materials may have been omitted from approved Submittals.

- F. Provide percentage of recycled content by weight including fly ash (20%) and recycled content.

1.5 QUALITY ASSURANCE

- A. All materials, measuring, mixing, transportation, placing and curing shall be subject to inspection by the Architect or by the testing agency. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of material or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.

- B. A qualified testing agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.

- C. The Contractor shall retain the services of a qualified testing agency, approved by the Architect, to test aggregate and to prepare or review mix designs for each strength of concrete specified, and shall submit mix designs and test results to the Architect for approval. The costs of all such services shall be borne by the Contractor.

- D. Advise the testing agency of intent to place concrete by notification at least 24 hours prior to the time of placement.

- E. Concrete will be sampled and tested for quality control as follows:

1. ASTM C 172: Sampling fresh concrete.
2. ASTM C 31: Compression test specimens.
3. ASTM C 143: Slump
4. ASTM C 231: Air content
5. ASTM C 39: Compressive strength.
6. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Uses as a Mineral Admixture in Portland Cement Concrete.
7. ASTM C 311: Standard Methods of Sampling and Testing Fly Ash and Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.

- F. All reinforcing shall be inspected by the testing agency for grade, size, spacing, position, cleanliness, cover and support.

- G. Cooperate with the testing agency's work and provide help as required for taking and storing samples. Provide storage facilities for concrete cylinders at the site. Facilities must protect cylinders from affects of low or high temperatures in cold or hot weather, respectively.

- H. Compression tests shall consist of six (6) cylinders for each test made, cured and tested by the laboratory during the progress of the job. At least one (1) test shall be made for each strength of concrete up to 50 cubic yards pour, and at least one (1) test per strength for each 50 cubic yards thereafter, unless otherwise directed by the Architect. Concrete for each set of cylinders shall be from one (1) sample representative of the entire batch. All cylinders shall be standard 6" X 12".

- I. In addition to the above, the Architect or the Contractor may direct additional control cylinders to be made, cured and tested to verify strengths for removal of forms, shoring or

adequacy for curing or cold weather protection. In such instances, the cylinders shall be cured in the same environment as the area which the cylinders represent. All such additional work requested by the Contractor shall be at his own expense.

J. Evaluation of Compression Tests:

1. Architect has authority to order, for any strength of concrete, increase in cement content and mix redesign for remaining work of either:
 - a. Average 7-day strength of any two consecutive tests representing a particular design strength of a class of concrete is less than 55 percent of specified strength; OR
 - b. Average 28-day strength of any two consecutive tests representing particular design strength of a class of concrete is less than 90 percent of specified strength.
2. The strength level of a class of concrete shall be considered satisfactory, if the following requirements are met:
 - a. Averages of any three consecutive 28-day strength tests representing each class of concrete equal or exceed the specified strength (f'c).
 - b. Not more than 10 percent of 28-day strength tests have values less than the specified strength (f'c).
 - c. No individual 28-day test shows an average strength less than 90 percent of specified strength (f'c).
3. When tests of control specimens fall below the strength level requirements, the Architect may require core specimens taken from concrete in question and tested in accordance with ASTM C 42. If these specimens do not meet the strength requirements, the Architect will have the right to require additional curing, load tests, strengthening or removal and replacement of those parts of the structure which are unacceptable, and in addition, removal of such sound portions of structure as necessary to insure safety, appearance and durability of the structure. Additional testing, load tests, strengthening or removal and replacement of parts of the structure and any costs associated with redesign or delay of the project shall be at the Contractor's expense.

K. Upon completion of concrete testing for the project the testing agency shall compile all results and perform a statistical strength analysis for each class of concrete in accordance with ACI 214.

L. Accept as final, results of tests made by the qualified professional testing organization engaged by the Owner.

M. Testing required because of changes requested by the Contractor in materials, sources of materials or mix proportions, and extra testing of concrete or materials because of failure to meet the Specification requirements is to be paid by the Contractor.

N. A final report shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.

1.6 NOTIFICATION OF RELATED TRADES

- A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, etc. when ready for such installation, and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.
- B. Leave openings in walls for pipes, ducts, etc. for mechanical and electrical work, as shown on Drawings or required by layout of mechanical systems.

1.7 ALTERNATES

- A. Alternates or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of Section 012300 – ALTERNATES and the following conditions:
 - 1. That request has been made and accepted prior to submission of Shop Drawings.
 - 2. That there is a substantial cost advantage or time advantage to the Owner.
 - 3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement

- 1. Portland Cement - ASTM C 150, Type I or II. Cement for exposed Architectural Concrete shall be specifically selected for “warm light” color as approved by the Architect and shall come from a single source.
- 2. Fly Ash – ASTM C 618 Class F.
- 3. Ground Granulated Blast-Furnace Slag – ASTM C 989 – Grade 100 or 120.

B. Natural Aggregate

- 1. Coarse Aggregate: Shall be hard, durable, uncoated crushed stone or gravel conforming to ASTM C 33. Typical coarse aggregate shall pass through a 3/4” sieve and meet the grading requirements of ASTM C 33 size number 67. Coarse aggregate for toppings less than 3” thick or areas with congested, closely spaced rebar shall pass through a 3/8” sieve and meet the grading requirements of ASTM C 33 size number 8. Coarse aggregate shall meet the following additional requirements:

Fineness Modulus:	6.70 and 5.5 respectively (+/- 0.20)
Organic:	Plate 1 maximum.
Silt:	1.0 % maximum
Soundness:	5% - 8% maximum loss, magnesium sulfate, five cycles.

Coarse aggregate for exposed Architectural concrete shall be specially selected for light color as approved by the Architect and shall come from a single source. Stockpile sufficient quantities to assure continuous supply.

- 2. Fine Aggregate: Shall be sand, clean, hard, durable, uncoated grains, free from silt, loam and clay, to meet ASTM C 33. Fine aggregate shall meet the following additional requirements:

<u>Sieve</u>	<u>Retained Percent</u>
#4	0-5
#16	25-40
#50	70-87
#100	93-97

Fineness Modulus: 2.8 (+/- 0.20)
 Organic: Plate 2 maximum
 Silt: 2.0% maximum
 Soundness: 5% - 10% maximum loss, magnesium sulfate, five cycles.

Fine aggregate for exposed, Architectural concrete shall be specially selected for light color as approved by the Architect, and shall come from a single source. Stockpile adequate amounts of fine aggregate to assure continuous supply.

C. Water

- 1. Water shall be from the local municipal supply.

D. Admixtures

- 1. Water-reducing Agent shall conform to ASTM C 494, Type A. Water-reducing agent shall be compatible with air-entraining agent.
- 2. Superplasticizer shall conform to ASTM C494, Type F or Type G. Superplasticizer shall be compatible with the other admixtures.
- 3. Air-entraining agent shall conform to ASTM C 260.
- 4. Calcium Chloride or admixtures containing more than 0.1% Chloride ions are not permitted.

E. Color Pigment:

- 1. ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis. Color to be selected by the Architect.

F. Concrete Reinforcement

- 1. Reinforcing steel shall conform to ASTM A 615 deformed bars, Grade 60. Reinforcing to be welded shall conform to ASTM A 706 deformed bars, Grade 60.
- 2. Welded wire fabric shall conform to ASTM A 185 in flat sheets.
- 3. Bar supports, metal accessories and other devices necessary for proper assembly of concrete reinforcing shall be of standardized factory-made wire bar supports. Wire for tying shall be ASTM A 82, 18 gauge black annealed wire. All accessories shall conform to Product Standard PS7-766, National Bureau of Standards, Department of Commerce, Class C.
- 4. Accessories touching formed surfaces exposed to view shall have not less than 1/4 inch of high density polyethylene between metal and concrete surface. Plastic tips

shall extend not less than 1/2 inch up on metal legs.

G. Formwork

1. Forms for concrete surfaces not exposed to view, shall be made of wood, metal, or other material subject to approval of Architect.
2. Form release agent shall be of a non-staining type, specifically manufactured for concrete forms.
3. Form ties shall be factory-fabricated, removable or snap back of approved design. Wire shall be at least 1-1/2" back from exterior surfaces and 1" from interior surfaces. Furnish with removable wooden or plastic cones of approved sizes where called for, with waterproof stop at exposed Architectural Concrete Surfaces.
4. Chamfer strips shall be one-half inch, 45 degree wood strips, or as detailed, nailed six inches on center, and installed at inside corners of all forms, unless otherwise directed by the Architect.
5. Reglets shall be formed from 24 gauge galvanized steel and shall be of type shown on Drawings or appropriate for use intended. Metal reglets shall be used merely as form to obtain desired profile. After concrete has set, remove reglets.
6. Forms for Architectural Exposed Concrete surfaces exposed to view in finished work shall be new Class 1 B-B High Density Overlay plyform, exterior grade not less than 5 ply nor less than 5/8 inch thick, conforming to U.S. Product Standard P-1-66.

H. Bonding agent for bonding new concrete to existing concrete at construction joints shall be Sikadur 32, Hi-Mod by Sika Corporation; Duralcrete by Euclid Chemical Co.; Deck-O-Weld by W.R. Meadows or equal approved by the Architect.

I. Self Leveling Concrete Underlayment

1. For areas to be covered by a finish or flooring:
Concrete underlayment used for floor leveling shall be "Sika Level-315" by Sika Corporation, "Ardex K-15" by Ardex, Inc., "ProSpec Level Set 300" by Bonsal American Inc. or equal approved by the Architect.
2. For areas to remain exposed:
Concrete underlayment used for floor leveling shall be "Sika Level-315" by Sika Corporation, "Ardex SD-T" by Ardex, Inc., "ProSpec Level Set Wear Topping" by Bonsal American Inc. or equal approved by the Architect.
3. Aggregate shall be well-graded, washed fine gravel (1/8 inch to 1/4 inch or larger) for use when underlayment is installed to a thickness where aggregate is recommended by the manufacturer.
4. Gypsum based underlayment products are not allowed.

J. Surface Conditioners

1. Floor Hardener shall conform to "Surfhard" by Euclid Chemical Company, Inc., "Hornolith" by W.R. Grace Company, "Chem Hard" by L & M Construction Chemicals or equal approved by the Architect.
2. Coordinate the use of floor hardeners with respective finish flooring subcontractors.
3. Sealer/Sealants for colored concrete: to be compatible with colored pigment admixture

K. Other Materials:

1. Joint filler where used with caulking or sealants, shall be cork type, non-extruding, self-expanding filler strips conforming to ASTM D 1752, III. Where no sealant or caulking is required, strips shall be closed cell flexible polyethylene type conforming to ASTM D 1752. Joint fillers for exterior paving shall be non-extruding bituminous type in accordance with ASTM D 1751.
2. Flexible epoxy joint sealant shall be "Sikadur 51 SL" by Sika Corporation, "Rezi-Weld Flez" by W.R. Meadows, "Dura 340" by Euclid Chemical Company, "Joint Tite 750" by L&M Construction Chemicals or approved equal.
3. Threaded Inserts: Richmond Screw Anchor Co. or equal structural concrete inserts of type shown on Drawings. Galvanize all components in accordance with ASTM A 153.
4. Waterproof Kraft Paper shall be in accordance with ASTM C 171.
5. Waterstops shall be bentonite strip type "Waterstop - RX", manufactured by Cetco, "Swellstop" by Greenstreak Inc., "Rockmax Swelling 101" by Rockmax Co. Ltd. or equal as approved by the Architect.
6. Non-Shrink Grout: Shall be "SetGrout" by Master Builders, "Sono Grout" by Sonneborn Contech, Inc. "Five Star Grout" by Five Star Products, Inc. or equal approved by the Architect.
7. Dovetail Anchor Slots shall be formed of not less than 20 gauge hot dipped galvanized steel, 1" by 1" and furnished with felt or fiber fillers.

2.2 CONCRETE MIXES

A. Strength, cement and water requirements:

Design Compr. Strength, f'c	Min. Cement Factor*		Max. Water Cement Ratio	
	Sacks/	lbs/	Gal/sack	Gal by wt.
3000	5.5	517	6.5	0.57
4000	6.5	611	5.5	0.49
4500	7.0	658	5.0	0.45

*Fly ash or slag may be used in all concrete except for interior slabs on metal deck, interior slabs on grade exterior walks or site walls. The amount shall be a maximum of 20% fly ash or 25% slag of the total cement content. Do not use slag during winter-concrete conditions.

- B. All concrete shall be proportioned in accordance with ACI Standard 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete" and comply with the requirements of ACI 301 "Specifications for Structural Concrete" Section 4, Method 1 (trial mixtures) or 2 (field test data).
- C. All 4000 psi concrete shall have a minimum coarse aggregate content of 1800 lbs/cu.yd.
- D. Air-entraining and water-reducing agents shall be used in strict accordance with the manufacturer's printed instructions. All exterior concrete subjected to freezing and thawing shall have a total air content of 5% plus or minus 1%. All interior concrete slabs shall have a maximum air content of 3% and all other interior concrete shall have a total air content of 4% plus or minus 1%. All concrete shall contain a water-reducing agent.

- E. Water-Cement Ratio - All concrete subjected to freezing and thawing shall have a maximum water-cement ratio of 0.49 ($f'c = 4000$ psi minimum). All concrete required to be watertight and/or subjected to de-icers shall have a maximum water-cement ratio of 0.45 ($f'c = 4500$ psi minimum). This is total water in mix at time of placement, including free water of aggregates and liquid admixtures.
- F. Slump of concrete shall be 4" (+/-1"). If a superplasticizer is used, the slump shall be 3" (+/-1") prior to adding the superplasticizer and 8" (+/-1") after adding the superplasticizer.
- G. Premix admixtures in solution form and dispense as recommended by the manufacturer. Include the water in the solution in the design water content of the mixtures.

PART 3 -EXECUTION

3.1 STORAGE

- A. All materials shall be stored to prevent damage from the elements and other causes.
- B. Cement and aggregates shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Any materials which have deteriorated, or which have been damaged, shall not be used for concrete.
- C. Store reinforcing steel on wood skids to protect it from earth and damage from trucking or other construction operations. Reinforcement shall be free from loose mill scale, rust, release agent, concrete splatter and other extraneous coatings at the time it is embedded in the concrete.
- D. All forms shall be stored in neat manner and orderly fashion, protected from the weather and abuse.
- E. Materials which are judged not acceptable for this project shall not be stored on the site, but shall be immediately removed from the site.

3.2 FORMING

- A. Formwork construction shall be as specified in ACI 347 "Guide to Formwork for Concrete".
 - 1. Provide Class A tolerances for all visually exposed concrete surfaces.
 - 2. Provide Class C tolerances for other concrete surfaces.
- B. Acceptable tolerances shall be as specified in ACI 117 "Standard Specifications for Tolerances for Concrete Construction and Materials".
- C. Forms shall be constructed to conform to shapes, lines, and dimensions shown, plumb and straight, and shall be maintained sufficiently rigid to prevent deformation under load. Forms shall be sufficiently tight to prevent the leakage of grout. Securely brace and shore forms to prevent displacement and to safely support the construction loads.
- D. Treat forms with a form release agent applied according to the manufacturer's instructions,

by roller, brush or spray to produce a uniform thin film without bubbles or streaks. Apply the release agent in two coats for the first use of the form and in one coat for each additional use.

3.3 MIXING PROCESS

- A. Ready-mixed concrete shall be mixed and transported in accordance with "Specification for Ready-Mixed Concrete" ASTM C 94, Alt. #3 and ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete". Follow manufacturer's recommendations for areas using color additive and provide colorant in the proportions recommended by the manufacturer and as related to the approved mock-up. .

3.4 REINFORCING

- A. Reinforcing shall be securely tied and supported to maintain proper spacing and cover during placing operations. Take particular care to bend tie wire ends away from exposed faces of beams, slabs, and columns. In no case shall ends of tie wires project towards or touch formwork. All reinforcing and accessories shall be placed in accordance with CRSI Standards 63 and 68. Reinforcing shall be free of excessive rust, scale or other coatings that will reduce bond.

3.5 EMBEDDED ITEMS

- A. Coordinate the installation of all embedded items required by other trades. Such items normally are to be in place prior to the placing of reinforcing steel.
- B. Place all anchor bolts, sleeves, inserts, etc. and secure properly.
- C. Conduits and Pipes by M.E.P. Contractors: Do not place conduit in concrete on metal deck.

3.6 JOINTS

- A. Provide construction joints as shown on the Drawings, but in any case limit the maximum dimensions for placement of concrete in any one placement as follows:

1.	Walls:	80 feet
2.	Slabs on Grade:	100 feet
3.	Slabs on Metal Deck:	100 feet

The time period between adjacent concrete pours on either side of the construction joint shall not be less than three (3) days to allow for drying shrinkage in the initial pour.

- B. Construction joints shall be formed with keyed bulkheads. At joint locations labeled on the drawings as roughened joints, the entire contact surface shall be mechanically roughened with a roughness of at least 1/4" amplitude and an approved bonding agent shall be used in accordance with the manufacturer's recommendations. All construction joints shall be free of debris. Reinforcement shall continue through the joint, and additional reinforcement shall be placed as indicated on the Drawings.

- C. Provide control joints as shown on the Drawings (refer also to Architectural drawings for exposed areas with added joints), but in any case limit the maximum dimensions between joints as follows:

1. Slabs-on-grade: 25 feet

- D. Control joints shall be saw cut, as early as practical, the day after placement and finishing of concrete. Discontinue 50% of the reinforcement at the joint. Do not place control joints in slabs on metal deck.

3.7 PLACING

- A. Notify the Architect and Structural Engineer at least 72 hours prior to each placement.
- B. Do not place concrete until soil bearing material, reinforcing steel, inserts, sleeves and other work to be built into the concrete have been inspected and approved by the Architect and all trades concerned.

- C. In hot weather, all concreting shall be done in accordance with ACI 305, "Recommended Practice for Hot Weather Concreting".

1. When temperature rises above 70 degrees F, all surfaces of concrete shall be protected against rapid drying.
2. Concrete delivered to the forms shall have a temperature of not over 90 degrees F.
3. The temperature of the forms shall not be over 90 degrees F.

- D. In cold weather, all concreting shall be done in accordance with ACI 306, "Recommended Practice for Cold Weather Concreting".

1. When the average daily temperature falls below 40 degrees F, all surfaces of concrete shall be maintained at a temperature of at least 50 degrees F and not over 90 degrees F for seven (7) days.
2. Concrete delivered to the forms shall have a temperature of at least 60 degrees F and not over 90 degrees F.
3. The temperature of the forms including gravel base, shall be at least 40 degrees F.
4. The Contractor shall maintain a record of temperature of the concrete at the most exposed surfaces of each placement at the beginning and at the end of each day of the curing period, which shall be available to the Architect.

- E. Conveying - Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent separation or loss of ingredients and in a manner which will assure that the required quality of the concrete is retained.

- F. Depositing - Delivery and placement of concrete shall be programmed so that the time lapse between batching and placement shall not exceed 1-1/2 hours. Concrete shall not be allowed a free fall of over 4 feet. Concrete shall be deposited as nearly as practicable in its final position, to avoid segregation due to rehandling or flowing.

- G. Concrete shall be deposited continuously, in horizontal layers of such thickness (not deeper than 18 inches) that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section.

Placing shall be carried out at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited.

- H. Concrete shall be consolidated with the aid of mechanical vibrators in conformance with ACI "Recommended Practice for Consolidation of Concrete" to produce a dense, homogeneous mass without voids or pockets. Vibrators should be placed in concrete rapidly so as to penetrate the entire previous lift, to blend the two layers. Vibrating techniques must assure that when the course aggregate reaches the form, it stops and the matrix fills the voids.
- I. At horizontal joints of floor and roof beams where mechanically roughened and cleaned surfaces are required, thoroughly clean all foreign materials and laitance, roughen with suitable tools such as chipping hammers or wire brushes and reclean by stream of water or compressed air. New concrete shall be deposited before bonding agent dries out.
- J. Each area of colored concrete on the project shall be installed in continuous pours. Should more than 1 batch (truck load) be required to complete the area, the concrete color shall be consistent in formula with adjacent pour(s). Provide sealant at the rates of application and methods as recommended by the manufacturer. Follow the manufacturer's recommendations as to the timing of the sealant application.

3.8 FINISHING OF CONCRETE SURFACES

- A. The intent of this Specification is to secure for the job, materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming materials specified. Surfaces which reveal, upon removal of forms, imperfections of such magnitude as to seriously impair the appearance of the structure, in the opinion of the Architect, shall be deemed cause for rejection, and concrete members containing such imperfections shall be entirely removed and replaced without damage to adjacent materials or extra expense to the Owner. Lesser imperfections of concrete surfaces shall be patched and finished in accordance with the following procedures.
- B. Patching - Areas to be patched shall not exceed 1.5 square feet for each 1000 square feet of surface area. Patches shall match in every respect, the color and texture of the surrounding surfaces. Mix formulation shall be determined by trial to obtain a color match when both the patch and the surrounding concrete are cured and dry. After initial set, surfaces of patches shall be textured manually to obtain a match with the surrounding surfaces. All patches are subject to Architect's final acceptance as to appearance and quality.
- C. Exposed Vertical Surfaces - Immediately after removal of forms, chip off all fins, and other projections, and patch all voids, honeycombs, and air pockets exceeding 3/4" in any dimension. In areas where concentrations of small voids occur, patch a sufficient number of voids to produce a uniform appearance across the entire panel. Smooth out projections and fins with wet carborundum stones or power grinders to extent directed by Architect. Pull tie rods and pack voids formed by tie-rod cones to a point 3/4" from finish surface. Patch exposed irregular lines at edges of slab soffits to produce neat, uniform appearance.
- D. All exposed concrete shall be thoroughly cleaned to remove stains, laitance, dust, form oil, and all other surface residue by use of water, stiff brushes, sandpaper or other means

approved by the Architect.

- E. Finishing of Concealed Concrete Surfaces - At surfaces to receive waterproofing membranes, chip off fins and other projections and trowel patch all voids, honeycombs and air pockets exceeding 1/2" in any dimension. Pull tie-rods and patch voids formed by tie-rod cones flush with adjacent surfaces. At outside faces of foundation walls, except for surfaces to receive waterproofing membranes, trowel patch all voids, honeycombs and air pockets exceeding 3/4" in depth. At other concealed surfaces, patching, if any, shall be as directed by the Architect and shall, in general, be only such as is required to assure or protect the structural integrity of concrete or reinforcing.
- F. Finishing Concrete Vertical Surfaces Exposed to View: Provide a smooth-formed surface obtained with selected form-facing material arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

Smooth-Rubbed Finish: Provide smooth-rubbed finish on exposed concrete vertical surfaces that have received smooth-formed finish treatment not later than one day after form removal.

Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.9 FLOOR AND OTHER FLATWORK FINISHES

- A. Concrete for finish floor slabs shall be poured as dry as practicable within allowable slump range. Except when otherwise indicated or specified, concrete floor slabs shall be monolithically finished at required elevation by screeding floating, and troweling to provide a smooth, even, non-porous finish, free of finishing marks. Do not begin finish troweling until concrete has hardened sufficiently to prevent excess fines from working to the surface. Finish requirements for formed concrete slabs, concrete slabs on deck and concrete slabs on grade are as follows:

Scratch Finish: At areas to receive a bonded, applied cementitious application, finish base slab as indicated above, except bull floats or darbys may be used. Thoroughly coarse wire broom within two hours after placing to roughen slab surface to ensure a permanent bond between base slab and applied cementitious materials.

Steel Trowel Finish: At areas to receive resilient floor covering or carpet, floors exposed to view, applied toppings and other interior surfaces, steel trowel immediately after floating. After initial troweling is complete and slabs have set sufficiently to ring the trowel, the surfaces shall be given a second steel troweling to a tight, but non burnished finish. The intent is to provide a smooth, ridge-free surface that will allow moisture within the concrete to escape more readily. Some grinding may be required.

Broom Finish: Provide edged and jointed broom finish for exposed concrete pavements, ramps, stairs, etc. Immediately following floating of surfaces to have broom finish, steel trowel the surface. Use a moistened, stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations as required to obtain a distinct edge. Match texture approved by Architect from sample panel.

Float Finish: Slabs to receive unbonded toppings, steel trowel finish, mortar setting beds, equipment pads, etc. shall be floated to a smooth, dense, uniform, sandy textured finish. During floating, while surface is still soft, check surface flatness using a 10 foot highway straight edge. Correct high spots by cutting down and correct low spots by filling with material of the same composition as floor finish.

- B. Concrete for floor slabs on metal deck shall be poured to the proper elevations by adding concrete to compensate for deck and structural member deflections. Slab thickness indicated on drawings is a minimum. Assume one and one quarter (1.25") inch additional thickness concrete at mid-bay required.
- C. Concrete floor slabs shall conform to the following flatness and levelness tolerances per ASTM E1155 for Specified Overall Values (SOV) and Minimum Local Values (MLV):

Carpeted areas:

Floor Flatness Number F_F :	Specified Overall Value (SOV) = 25 Minimum Local Value (MLV) = 17
Floor Levelness Number F_L :	Specified Overall Value (SOV) = 20 Minimum Local Value (MLV) = 15

Exposed areas or areas to receive wood flooring, resilient flooring, or thin set tile:

Floor Flatness Number F_F :	Specified Overall Value (SOV) = 35 Minimum Local Value (MLV) = 25
Floor Levelness Number F_L :	Specified Overall Value (SOV) = 20 Minimum Local Value (MLV) = 15

Gymnasium slab on grade only:

Floor Flatness Number F_F :	Specified Overall Value (SOV) = 40 Minimum Local Value (MLV) = 30
Floor Levelness Number F_L :	Specified Overall Value (SOV) = 25 Minimum Local Value (MLV) = 20

Measurements shall be taken by the Testing Agency in accordance with ASTM E1155, as directed by the Architect. Measurements shall be taken within 72 hours of concrete placement to verify compliance with FF and FL requirements. Leveling of the slab by the Contractor to the required tolerances, if not achieved by initial finishing, shall be by machine grinding or by special leveling compound, or both, as approved by the Architect.

Note: Only F_F numbers are applicable to elevated reinforced concrete slabs and slabs on metal deck. Both F_F and F_L numbers are applicable to slabs on grade.

- D. Elevation Tolerance: The top surface elevation of slabs on metal deck and slabs on grade must not vary from the specified design elevation by more than +/- 3/8" (3/4" envelope), as measured at 80% of all points.

- E. Concrete slab surfaces to be sloped shall be sloped uniformly to drains or as indicated on the Drawings.
- F. Concrete slabs to receive Portland cement setting beds or concrete or fills shall be given a rough wood float or broom finish.
- G. Provide edged and jointed broom finish for exposed concrete pavements. Immediately following floating of surfaces to have broom finish, steel trowel the surface. Use a stiff bristled natural fiber broom with a long handle to obtain a heavy brush texture finish. Install brush marks perpendicular to the flow of traffic. Repeat edging and jointing operations as required to obtain a distinct edge.
- H. No dry cement or mixture of sand and cement shall be applied to surface of any concrete slab to absorb moisture.
- I. Protect floors from damage until completion of job.

3.10 SURVEY

- A. The Contractor shall provide as-built surveys of concrete slabs at all levels in accordance with ASTM E1155 and ACI 117.
- B. Submit a summary of results at each level for review by the Architect. Additional readings may be requested, at the direction of the Architect. Floor leveling, if required, shall be as specified in Section 3.11.

3.11 FLOOR LEVELING

- A. Place self leveling concrete underlayment for floor leveling in accordance with manufacturer's recommendations:
 - 1. Remove all dirt, grease, sealers, etc. from existing slab by sandblasting or power wash.
 - 2. Prime and seal entire surface to receive topping. Use bonding agent, applied in strict conformance with manufacturer's instructions.
 - 3. Pour or pump, mixed rough course of underlayment material onto primed area in accordance with manufacturer's instructions, filling areas to within 3/4 inch of finish elevation at mid-bay. This rough course shall consist of the underlayment material, mixed with fine gravel aggregate (3/8" maximum size), as applicable and as required by manufacturer.
 - 4. After allowing rough course to set, prime with bonding agent and place finish course of underlayment material to within 1/4 inch of finish elevation at mid-bay. Protect newly applied underlayment from premature surface drying and moisture loss.

3.12 CURING AND PROTECTION

- A. Protect newly placed concrete against low and high temperature effects and against rapid

loss of moisture. Cure all concrete for at least seven (7) days at a temperature of at least 50 degrees F by curing methods approved by the Architect. Curing compounds shall not be used.

- B. Vertical or near vertical surfaces may be cured by maintaining wood forms continuously wet during curing period, by wrapping with continuous .006" polyethylene with taped joints or as approved by the Architect.
- C. Floor surfaces, after hardening sufficiently to prevent damage, and normally within several hours after final troweling, shall be covered with reinforced, waterproof kraft paper with taped, lapped seams.

3.13 FORM REMOVAL

- A. Forms shall be removed without damage to concrete. The contractor shall be responsible for the safety of the construction during and after form removal. No act of the Architect shall relieve him of this responsibility.
- B. Protect corners from damage after form removal by boxing, corner boards or other means approved by the Architect.
- C. Formwork for pilasters, walls, and other parts not supporting the weight of concrete may be removed as soon as the concrete has reached 30% of its specified 28-day strength, but not before 2 days, provided it is properly cured and protected.
- D. Foundation walls to retain earth shall not be backfilled until the connecting slabs at the top and bottom of the wall have achieved their 28 day strength. Alternatively, the contractor may provide an engineered wall bracing system to withstand wall earth pressures during construction prior to slab bracing.

3.14 WATERSTOP

- A. Install continuous Bentonite strip waterstop at vertical and horizontal below grade wall construction joints. Installation shall be in accordance with manufacturer's recommendations.

3.15 CUTTING OF HOLES

- A. Holes required by other trades in any cast-in-place concrete which did not receive sleeves shall be cut by the respective trades. Use a core drilling process or sawing process which produces clean sharp edges and the minimum hole size which accommodates the piping, conduit, or equipment requiring the opening. Field locate all reinforcing bars prior to coring and do not cut bars.
- B. Obtain approval of Architect before cutting any holes for any trades.

3.16 FLOOR HARDENING

- A. All interior concrete floors remaining exposed in the finished work shall be treated with a chemical hardener in a three-coat application, not sooner than 28 days after pouring of slab, in accordance with manufacturer's specifications.

3.17 NON-SHRINK GROUT

- A. Grout solid all column leveling plates and beam bearing plates in accordance with manufacturer's recommendations.

END OF SECTION 033000

SECTION 034500

ARCHITECTURAL PRECAST CONCRETE

(Part of Work of Section 040001 - MASONRY WORK, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Architectural precast concrete sills, bases, and other indicated shapes.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for installing connection anchors in concrete.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING for furnishing and installing connections attached to structural-steel framing.
 - 3. Section 055000 - METAL FABRICATIONS for miscellaneous steel shapes.

1.3 DEFINITION

- A. Design Reference Sample: Sample of approved architectural precast concrete color, finish, and texture, preapproved by Architect.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide architectural precast concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated.
 - 1. Wind Loads: As required by Code.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Design Mixtures: For each precast concrete mixture. Include compressive strength and water-absorption tests.
- D. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.
 - 1. Indicate separate face and backup mixture locations and thicknesses.
 - 2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
 - 3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
 - 4. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
 - 5. Include plans and elevations showing unit location and sequence of erection for special conditions.
 - 6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
 - 7. Indicate relationship of architectural precast concrete units to adjacent materials.
 - 8. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
 - 9. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Show governing panel types, connections, and types of reinforcement, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame from architectural precast concrete.
- E. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 12 by 12 by 2 inches.
 - 1. When other faces of precast concrete unit are exposed, include Samples illustrating workmanship, color, and texture of backup concrete as well as facing concrete.
 - 2. Provide custom sample to match color and texture of Architect's sample.
- F. Welding certificates.
- G. Qualification Data: For Installer and fabricator
- H. Material Test Reports: For aggregates.
- I. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
 - 1. Cementitious materials.
 - 2. Reinforcing materials and prestressing tendons.
 - 3. Admixtures.
 - 4. Bearing pads.
 - 5. Structural-steel shapes and hollow structural sections.

- J. Source quality-control test reports.
- K. Field quality-control test and special inspection reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A precast concrete erector qualified and designated by PCI's Certificate of Compliance to erect Category A (Architectural Systems) for non-load-bearing members.
- B. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 1. Participates in PCI's plant certification program and is designated a PCI-certified plant for Group A, Category A1 - Architectural Cladding and Load Bearing Units.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- D. Design Standards: Comply with ACI 318 and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of architectural precast concrete units indicated.
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."
- F. Welding: Qualify procedures and personnel according to AWS D1.1/D.1.1M, "Structural Welding Code - Steel"; and AWS D1.4, "Structural Welding Code - Reinforcing Steel."
- G. Sample Panels: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample panels approximately 3 sq. ft. in area for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.
 - 1. Locate panels where indicated or, if not indicated, as directed by Architect.
 - 2. Damage part of an exposed-face surface for each finish, color, and texture, and demonstrate adequacy of repair techniques proposed for repair of surface blemishes.
 - 3. After acceptance of repair technique, maintain one sample panel at manufacturer's plant and one at Project site in an undisturbed condition as a standard for judging the completed Work.
 - 4. Demolish and remove sample panels when directed.
- H. Range Samples: After sample panel approval and before fabricating architectural precast concrete units, produce a minimum of 5 sets of samples, approximately 3 sq. ft. in area, representing anticipated range of each color and texture on Project's units. Following range sample, maintain one set of samples at Project site and remaining sample sets at manufacturer's plant as color and texture approval reference.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground.
- B. Support units during shipment on nonstaining shock-absorbing material.
- C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.
- D. Place stored units so identification marks are clearly visible, and units can be inspected.
- E. Handle and transport units in a position consistent with their shape and design in order to avoid excessive stresses which would cause cracking or damage.
- F. Lift and support units only at designated points shown on Shop Drawings.

1.8 PROJECT CONDITIONS

- A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.

1.9 SEQUENCING

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

- A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
 - 1. Mold-Release Agent: Commercially produced liquid-release agent that will not bond with, stain or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated. Furnish with manufacturer's recommended liquid-release agent that will not bond with, stain, or adversely affect precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.
- C. Surface Retarder: Chemical set retarder, capable of temporarily delaying final hardening of newly placed concrete mixture to depth of reveal specified.

2.2 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M epoxy coated.
- D. Epoxy-Coated-Steel Wire: ASTM A 884/A 884M, Class A coated, deformed, flat sheet, Type 1 bendable coating.
- E. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 117.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.
 - 1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin Admixture: ASTM C 618, Class N.
 - 3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
 - 1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.
 - a. Gradation: To match design reference sample.
 - 2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.
- D. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.
 - 1. Custom Color: Match Architects sample.
- E. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.
- F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

2.4 STAINLESS-STEEL CONNECTION MATERIALS

- A. Stainless-Steel Plate: ASTM A 666, Type 304, of grade suitable for application.
- B. Stainless-Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316, hex-head bolts and studs; stainless-steel nuts; and flat, stainless-steel washers.

1. Lubricate threaded parts of stainless-steel bolts with an antiseize thread lubricant during assembly.

- C. Stainless-Steel-Headed Studs: ASTM A 276, with minimum mechanical properties of PCI MNL 117, Table 3.2.3.

2.5 BEARING PADS

- A. Provide one of the following bearing pads for architectural precast concrete units as recommended by precast fabricator for application:

1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, Type A durometer hardness of 50 to 70, ASTM D 2240, minimum tensile strength 2250 psi, ASTM D 412.
2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Type A durometer hardness of 70 to 90, ASTM D 2240; capable of supporting a compressive stress of 3000 psi with no cracking, splitting, or delaminating in the internal portions of pad. Test one specimen for every 200 pads used in Project.
3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric bonded to an elastomer; Type A durometer hardness of 80 to 100, ASTM D 2240; complying with AASHTO's "AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications, Division II, Section 18.10.2, or with MIL-C-882E.
4. Frictionless Pads: Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plate, of type required for in-service stress.
5. High-Density Plastic: Multimonomer, nonleaching, plastic strip.

2.6 ACCESSORIES

- A. Reglets: Stainless steel, Type 302 or 304, felt or fiber filled, or with face opening of slots covered.
- B. Precast Accessories: Provide clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units.

2.7 GROUT MATERIALS

- A. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

- D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi minimum.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to PCI MNL 117.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.9 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of molds with release agent before reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concrete placement. Coat form liner with form-release agent.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Form joints are not permitted on faces exposed to view in the finished work.
 - 2. Edge and Corner Treatment: Uniformly chamfered.

2.10 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.

- E. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete. When damage to epoxy-coated reinforcing exceeds limits specified in ASTM A 775/A 775M, repair with patching material compatible with coating material and epoxy coat bar ends after cutting.
 - 2. Accurately position, support, and secure reinforcement against displacement during concrete-placement and consolidation operations. Completely conceal support devices to prevent exposure on finished surfaces.
 - 3. Place reinforcement to maintain at least 3/4-inch minimum coverage. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 4. Place reinforcing steel and prestressing strand to maintain at least 3/4-inch minimum concrete cover. Increase cover requirements for reinforcing steel to 1-1/2 inches when units are exposed to corrosive environment or severe exposure conditions. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Direct wire tie ends away from finished, exposed concrete surfaces.
 - 5. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

- F. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.

- G. Prestress tendons for architectural precast concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 117.
 - 1. Delay detensioning or post-tensioning of precast, prestressed architectural concrete units until concrete has reached its indicated minimum design release compressive strength as established by test cylinders cured under same conditions as concrete.
 - 2. Detension pretensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
 - 3. If concrete has been heat cured, detension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 - 4. Protect strand ends and anchorages with bituminous, zinc-rich, or epoxy paint to avoid corrosion and possible rust spots.

- H. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

- I. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

- J. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.
 - 1. Place backup concrete mixture to ensure bond with face-mixture concrete.

- K. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."
- L. Comply with PCI MNL 117 for hot- and cold-weather concrete placement.
- M. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.
- N. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.
- O. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.11 FABRICATION TOLERANCES

- A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.
- B. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with the following product tolerances:
 1. Overall Height and Width of Units, Measured at the Face Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/8 inch.
 - b. 10 to 20 feet, plus 1/8 inch, minus 3/16 inch.
 - c. 20 to 40 feet, plus or minus 1/4 inch.
 - d. Each additional 10 feet, plus or minus 1/16 inch.
 2. Overall Height and Width of Units, Measured at the Face Not Exposed to View: As follows:
 - a. 10 feet or under, plus or minus 1/4 inch.
 - b. 10 to 20 feet, plus 1/4 inch, minus 3/8 inch.
 - c. 20 to 40 feet, plus or minus 3/8 inch.
 - d. Each additional 10 feet, plus or minus 1/8 inch.
 3. Total Thickness or Flange Thickness: Plus 1/4 inch, minus 1/8 inch.
 4. Rib Thickness: Plus or minus 1/8 inch.
 5. Rib to Edge of Flange: Plus or minus 1/8 inch.
 6. Distance between Ribs: Plus or minus 1/8 inch.
 7. Variation from Square or Designated Skew (Difference in Length of the Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches or 1/2 inch total, whichever is greater.
 8. Length and Width of Block-outs and Openings within One Unit: Plus or minus 1/4 inch.
 9. Location and Dimension of Block-outs Hidden from View and Used for HVAC and Utility Penetrations: Plus or minus 3/4 inch.

10. Dimensions of Haunches: Plus or minus 1/4 inch.
 11. Haunch Bearing Surface Deviation from Specified Plane: Plus or minus 1/8 inch.
 12. Difference in Relative Position of Adjacent Haunch Bearing Surfaces from Specified Relative Position: Plus or minus 1/4 inch.
 13. Bowing: Plus or minus L/360, maximum 1 inch.
 14. Local Smoothness: 1/4 inch per 10 feet.
 15. Warping: 1/16 inch per 12 inches of distance from nearest adjacent corner.
 16. Tipping and Flushness of Plates: Plus or minus 1/4 inch.
 17. Dimensions of Architectural Features and Rustications: Plus or minus 1/8 inch.
- C. Position Tolerances: For cast-in items measured from datum line location, as indicated on Shop Drawings.
1. Weld Plates: Plus or minus 1 inch.
 2. Inserts: Plus or minus 1/2 inch.
 3. Handling Devices: Plus or minus 3 inches.
 4. Reinforcing Steel and Welded Wire Fabric: Plus or minus 1/4 inch where position has structural implications or affects concrete cover; otherwise, plus or minus 1/2 inch.
 5. Reinforcing Steel Extending out of Member: Plus or minus 1/2 inch of plan dimensions.
 6. Tendons: Plus or minus 1/4 inch, vertical; plus or minus 1 inch, horizontal.
 7. Location of Rustication Joints: Plus or minus 1/8 inch.
 8. Location of Opening within Panel: Plus or minus 1/4 inch.
 9. Location of Flashing Reglets: Plus or minus 1/4 inch.
 10. Location of Flashing Reglets at Edge of Panel: Plus or minus 1/8 inch.
 11. Reglets for Glazing Gaskets: Plus or minus 1/8 inch.
 12. Electrical Outlets, Hose Bibs: Plus or minus 1/2 inch.
 13. Location of Bearing Surface from End of Member: Plus or minus 1/4 inch.
 14. Allowable Rotation of Plate, Channel Inserts, and Electrical Boxes: 2-degree rotation or 1/4 inch maximum over the full dimension of unit.
 15. Position of Sleeve: Plus or minus 1/2 inch.
 16. Location of Window Washer Track or Buttons: Plus or minus 1/8 inch.

2.12 FINISHES

- A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved sample panels and as follows:
1. Custom Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attack. Match Architect's sample.
 2. Color: Provide custom color to match Architect's sample.
- B. Finish exposed top and bottom surfaces of architectural precast concrete units to match face-surface finish.
- C. Finish exposed back surfaces of architectural precast concrete units by smooth, steel-trowel finish.

2.13 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR-6,

"Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

- B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.
 - 1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixtures as may be requested for additional testing and evaluation.
- C. Strength of precast concrete units will be considered deficient if units fail to comply with ACI 318 requirements for concrete strength.
- D. Testing: If there is evidence that strength of precast concrete units may be deficient or may not comply with ACI 318 requirements, precaster will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42/C 42M.
 - 1. A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 - 2. Cores will be tested in an air-dry condition.
 - 3. Strength of concrete for each series of 3 cores will be considered satisfactory if average compressive strength is equal to at least 85 percent of 28-day design compressive strength and no single core is less than 75 percent of 28-day design compressive strength.
 - 4. Test results will be made in writing on same day that tests are performed, with copies to Architect, Contractor, and precast concrete fabricator. Test reports will include the following:
 - a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of precast concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- E. Patching: If core test results are satisfactory and precast concrete units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture that has no coarse aggregate, and finish to match adjacent precast concrete surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting structural frame or foundation and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

- C. Do not install precast concrete units until supporting cast-in-place building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is complete.

3.2 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.
- B. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.
 - 1. Install temporary steel or plastic spacing shims or bearing pads as precast concrete units are being erected. Tack weld steel shims to each other to prevent shims from separating.
 - 2. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 3. Remove projecting lifting devices and grout fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 4. Unless otherwise indicated, maintain uniform joint widths of 3/4 inch.
- C. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
 - 1. Do not permit connections to disrupt continuity of roof flashing.
- D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.4 for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
 - 1. Protect architectural precast concrete units and bearing pads from damage by field welding or cutting operations, and provide noncombustible shields as required.
 - 2. Welds not specified shall be continuous fillet welds, using no less than the minimum fillet as specified by AWS.
 - 3. Clean weld-affected metal surfaces with chipping hammer followed by brushing, and apply a minimum 4.0-mil- thick coat of galvanized repair paint to galvanized surfaces according to ASTM A 780.
 - 4. Remove, reweld, or repair incomplete and defective welds.
- E. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
 - 1. Where slotted connections are used, verify bolt position and tightness. For sliding connections, properly secure bolt but allow bolt to move within connection slot. For friction connections, apply specified bolt torque and check 25 percent of bolts at random by calibrated torque wrench.
- F. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

3.3 ERECTION TOLERANCES

- A. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.
- B. Erect architectural precast concrete units level, plumb, square, and true, without exceeding the following noncumulative erection tolerances:
 - 1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
 - 2. Plan Location from Centerline of Steel: Plus or minus 1/2 inch.
 - 3. Top Elevation from Nominal Top Elevation: As follows:
 - a. Exposed Individual Panel: Plus or minus 1/4 inch.
 - b. Non-Exposed Individual Panel: Plus or minus 1/2 inch.
 - c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
 - d. Non-Exposed Panel Relative to Adjacent Panel: 1/2 inch.
 - 4. Support Elevation from Nominal Support Elevation: As follows:
 - a. Maximum Low: 1/2 inch.
 - b. Maximum High: 1/4 inch.
 - 5. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Feet: 1 inch.
 - 6. Plumb in Any 10 Feet of Element Height: 1/4 inch.
 - 7. Maximum Jog in Alignment of Matching Edges: 1/4 inch.
 - 8. Joint Width (Governs over Joint Taper): Plus or minus 1/4 inch.
 - 9. Maximum Joint Taper: 3/8 inch.
 - 10. Joint Taper in 10 Feet: 1/4 inch.
 - 11. Maximum Jog in Alignment of Matching Faces: 1/4 inch.
 - 12. Differential Bowing or Camber, as Erected, between Adjacent Members of Same Design: 1/4 inch.
 - 13. Opening Height between Spandrels: Plus or minus 1/4 inch.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and prepare reports:
 - 1. Erection of precast concrete members.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.
- D. Testing agency will report test results promptly and in writing to Contractor and Architect.
- E. Repair or remove and replace work where tests and inspections 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.

3.5 REPAIRS

- A. Repair architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.
- D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.6 CLEANING

- A. Clean surfaces of precast concrete units exposed to view.
- B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.
- C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION

SECTION 040001

MASONRY WORK

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 040001 – MASONRY WORK

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable.

D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
To be issued with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 034500 – ARCHITECTURAL PRECAST CONCRETE
 2. All Work of Section 042000 – UNIT MASONRY

END OF SECTION

SECTION 042000

UNIT MASONRY

(Part of Work of Section 040001 - MASONRY WORK, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Concrete masonry units.
2. Face brick.
3. Embedded flashing.
4. Mortar and grout.
5. Reinforcing steel, masonry joint reinforcement, ties and anchors.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Items To Be Installed Only:

1. Section 055000 - METAL FABRICATIONS:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
2. Section 055100 - METAL STAIRS AND RAILINGS:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
3. Section 061000 - ROUGH CARPENTRY:
 - a. Wood nailers and blocking built into masonry.
4. Section 083110 – ACCESS DOORS AND FRAMES
 - a. Access doors and frames in masonry openings.
5. Section 142100 – ELECTRIC TRACTION ELEVATORS:
 - a. Elevator rail bracket inserts.

- D. Items To Be Furnished Only:

1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Dovetail slots for masonry anchors.
2. Section 051200 - STRUCTURAL STEEL FRAMING:
 - a. Anchor sections of adjustable masonry anchors for connecting to structural frame.

- E. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 061600 - SHEATHING for gypsum sheathing on cold-formed metal framing.
 2. Section 072100 - THERMAL INSULATION for cavity wall insulation.
 3. Section 072700 - AIR BARRIERS for membrane air barrier.
 4. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint systems openings in masonry walls and at heads of masonry walls.
 5. Section 079200 - JOINT SEALANTS for sealing control and expansion joints in unit masonry.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. 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."
- D. Samples for Verification: For each type and color of the following:
1. Exposed concrete masonry units.
 2. Face brick, in the form of straps of five or more bricks.
 3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
 4. Weep holes/vents.
 5. Accessories embedded in masonry.
- E. Qualification Data: For testing agency.
- F. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
1. Masonry units:
 - a. Include material test reports substantiating compliance with requirements.
 - b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
 - c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
 - d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Cementitious materials. Include brand, type, and name of manufacturer.
 3. Mortar mixes. Include description of type and proportions of ingredients.
 4. Grout mixes. Include description of type and proportions of ingredients.
 5. Reinforcing bars.
 6. Joint reinforcement.
 7. Anchors, ties, and metal accessories.

- G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports, per ASTM C 780 for mortar mixes required to comply with property specification.
 - 2. Include test reports, per ASTM C 1019 for grout mixes required to comply with compressive strength requirement.
- H. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Preconstruction Testing Service: The Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by the Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
 - 1. Prism Test: For each type of construction required, per ASTM C 1314.
- E. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
- F. Sample Panels: Build sample panels to verify selections made under sample submittals and to demonstrate aesthetic effects. Comply with requirements in Division 01 for mockups.
 - 1. Build sample panels for typical exterior and interior walls in sizes approximately 48 inches long by 48 inches high by full thickness.
 - 2. Clean one-half of exposed faces of panels with masonry cleaner indicated.
 - 3. Protect approved sample panels from the elements with weather-resistant membrane.
 - 4. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
 - a. 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.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Agenda shall include protection of air barrier membrane during construction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

- A. Protection of Air Barrier Membrane: During construction, protect air barrier membrane from penetrations which allow air to pass through air barrier assemblies. Engage original installer to repair damage promptly using identical materials and methods of installation, and to the satisfaction of the Architect.
- B. 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 and hold cover securely in place.
 - 2. Where 1 wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- C. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.
- D. 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.
- E. 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 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- F. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

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

2.2 CONCRETE MASONRY UNITS (CMUs)

- A. Regional Materials: Provide CMUs that have been 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 Project site.
- B. Concrete Masonry Units: ASTM C 90, normal weight unless indicated otherwise manufactured to dimensions 3/8 inch less than nominal dimensions.
- C. Shapes: Provide standard shapes indicated and as required for building configuration. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
- D. Decorative Concrete Masonry Units: ASTM C 90.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3500 psi in accordance with ASTM C140.
 2. Weight Classification: Normal weight.
 3. Sizes: 3 5/8" w x 15 5/8" x 15 5/8" h, 3 5/8" w x 3 5/8" x 16 5/8" h, and 3 5/8" w x 7 5/8" x 16 5/8" h – with center score line, unless noted otherwise (solid at exterior).
 4. Pattern and Texture:
 - a. Standard pattern, Ground face, filled and polished finish.
 5. Colors: As selected by Architect from manufacturer's full range.
 6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.
 7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. A Jandris & Sons
 - b. Trenwyth Industries.
 - c. Westbrook Concrete Block Co.
 8. Basis of Design: Provide Verastone Plus Monumental as manufactured by Trenwyth Industries, or approved equal.

- E. Integral Water Repellent: Provide units made with integral water repellent for exterior exposed units.
 - 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 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen. Available products include:
 - a. Addiment Incorporated, a Div. of Grace Construction Products; Block Plus W-10.
 - b. Grace Construction Products; Dry-Block.
 - c. BASF Construction Chemicals; Rheopel.

2.3 BRICK

- A. Regional Materials: Provide brick that has been manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Face Brick: ASTM C 216, Grade SW, Type FBS.
 - 1. Trade Reference and Color:
 - a. Bowerstone, Olde Windsor (no darks); Basis of Design.
 - b. McAvoy, Westtown (no darks).
 - 2. Size: 3 5/8" w x 11 5/8" l x 3 5/8" h; utility.
 - 3. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
 - 4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
- C. Building (Common) Brick where Concealed: ASTM C 62, Grade SW.
- D. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
 - 3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces.
 - 4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
 - 5. Units which are sawn and less than one-half full size shall not be used.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.
- B. Portland Cement: ASTM C 150, 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 C 207, Type S.
- D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Available Products:
 - a. LanXess; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- E. Aggregate for Mortar: ASTM C 144. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
- F. Aggregate for Grout: ASTM C 404.
- G. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer. Available products include:
 - 1. Addiment Incorporated, a Div. of Grace Construction Products; Mortar Tite.
 - 2. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
 - 3. BASF Construction Chemicals; Rheopel Mortar Admixture.
- H. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Mill-galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size and Spacing: As required by Code.
 - 4. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Multiwythe Masonry:
 - 1. Ladder type with 1 side rod at each face shell of hollow masonry units more than 4 inches in width, plus 1 side rod at each wythe of masonry 4 inches or less in width.

2.6 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
 - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 316.
 - 3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 4. Stainless Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

- B. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, hot-dip galvanized steel. Mill-galvanized wire may be used at interior walls, unless otherwise indicated.
- C. Partition Top Anchors: 0.097-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- D. Stone Anchors: Fabricate dowels, cramps, and other stone anchors from stainless steel.
- E. Adjustable Masonry-Veneer Anchors:
 - 1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, with structural performance capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
 - 2. Provide custom length as required for indicated cavity size.
 - 3. Screw-Attached, Masonry-Veneer Anchors: Units, equal to Pos-I-Tie Brick Veneer Anchoring System by Heckmann Building Products Inc., consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Zinc-alloy barrel section with flanged head with wing-nut eye and corrosion-resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.
 - b. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, hot-dip galvanized steel wire.

2.7 MISCELLANEOUS ANCHORS

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

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with Section 076200 - Sheet Metal Flashing and Trim and as follows:
 - 1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch (0.40 mm) thick.
 - 2. Configuration: Provide continuous flashing including preformed outside, inside corners, and end dams with smooth uninterrupted soldered seams and hemmed edges to maintain continuity. See drawings for profiles required.
- B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 – Sheet Metal Flashing and Trim.
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates. Verify compatibility between flashing materials and substrates.

- D. Drip Edge: Provide type 316, 0.016 inch (0.40 mm) thick stainless steel drip edge plates with factory applied adhesive strip for all through-wall flashing conditions. Provide preformed outside and inside corner drip plate corners with smooth uninterrupted soldered seams and hemmed drip edges to maintain continuity. Custom sizes will be required see drawings for profiles required.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent Products: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity. Provide strips, full-depth of cavity and 10 inches wide, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings or equivalent. Available products:
 - 1. Advanced Building Products Inc.; Mortar Break II.
 - 2. Archovations, Inc.; CavClear Masonry Mat.
 - 3. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
 - 4. Mortar Net USA, Ltd.; Mortar Net.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Available Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 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. Limit cementitious materials in mortar to portland cement and lime.

- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S.
 - 3. For 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.
- C. Pigmented Mortar: Use colored cement product. Pigments shall not exceed 10 percent of portland cement by weight.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of 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.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Do not use units cut to less than one-half size.

- E. Do not install concrete masonry units with more than 5 percent damage to the face. Do not install brick units which will show defects after installation.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- G. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.
- H. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. 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.
 - 2. 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.
 - 3. 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.
 - 4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 5. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
 - 6. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in 1/3 running bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs. Prior to installation review bond pattern with Architect.
- C. 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, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
- F. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- G. 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 078440 – FIRE-RESISTIVE JOINT SYSTEMS.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick and concrete masonry units as follows:
1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. For interior masonry, tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. For exterior masonry, provide weathered joints.
- E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint), unless otherwise indicated.

3.5 CAVITY WALLS

- A. Bond wythes of cavity walls together using one of the following methods:
1. Masonry Joint Reinforcement: Installed in horizontal mortar joints. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement with continuous horizontal wire in facing wythe attached to ties to allow for differential movement regardless of whether bed joints align.
 2. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.
- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.
- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- D. Coordinate and allow access for air and vapor barrier membrane installed in cavity under Section 072700 - AIR BARRIERS.

3.6 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.
- 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.

3.7 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
 - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.8 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers with masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached anchors through insulation and sheathing to wall framing and to concrete and masonry backup as applicable with metal fasteners of type indicated.
 - 2. Embed tie sections in masonry joints. Provide air space indicated on the Drawings between back of masonry veneer and face of insulation.
 - 3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 - 4. Space anchors as required by Code.
 - 5. Engineer anchors for indicated cavity size.

3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units 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. Form expansion joints in brick made from clay or shale as follows:
 - 1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
 - 2. Build flanges of factory-fabricated, expansion-joint units into masonry.
 - 3. Build in compressible joint fillers where indicated.
 - 4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 - JOINT SEALANTS.

- D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 - JOINT SEALANTS but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.10 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.11 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:
 - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 - 2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe. Form 1/4-inch hook in edge of flashing embedded in inner wythe.
 - 3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge covered with elastomeric membrane, lapping at least 4 inches.
 - 4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.
- E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use open head joints to form weep holes.

2. Space weep holes 24 inches o.c., unless otherwise indicated.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

G. Install vents in head joints in exterior wythes at spacing indicated.

3.12 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 temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.13 FIELD QUALITY CONTROL

A. Inspectors: Engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof. Test types as determined by the independent testing and inspection agency.

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, around penetrations and 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** nonmasonry 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 brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. 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 Division 31 - EARTHWORK.
 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 the Site.

END OF SECTION

SECTION 050001

MISCELLANEOUS AND ORNAMENTAL IRON

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Sub-bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 050001-MISCELLANEOUS AND ORNAMENTAL IRON

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
To be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work in Section 055000 - METAL FABRICATIONS.
 2. All Work of Section 055100 - METAL STAIRS AND RAILINGS.
 3. All Work of Section 055300 - METAL GRATING.

END OF SECTION

SECTION 051200

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Work Included: The work of this Section consists of furnishing and erecting all structural steel work and Architecturally Exposed Structural Steel work (AESS) as shown on the Drawings and as specified herein and includes, but is not limited to, the following:
 - 1. Leveling plates and anchor bolts.
 - 2. Columns with base plates and connections.
 - 3. Beams with connections.
 - 4. Channels, angles, plates, frames, anchors, etc.
 - 5. Moment connections.
 - 6. Steel bracing with connections.
 - 7. Shop paint and field touch-up paint after erection.
 - 8. Galvanizing.
 - 9. As-Built column and base plate surveys.

All structural steel that is exposed in the finish work shall be Architecturally Exposed Structural Steel work (AESS). Coordinate locations of all AESS with Architectural Drawings.

- B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 033000 -CAST-IN-PLACE CONCRETE: Anchor bolts, embedded shapes with bolts or anchors, as indicated on the Drawings.
- C. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.

D. Related Work: Related work shall be performed under the following Sections:

1. Section 033000 - CAST-IN-PLACE CONCRETE.
2. Section 051226 – SHEAR CONNECTORS
3. Section 052100 - STEEL JOIST FRAMING.
4. Section 053100 - STEEL DECKING.
5. Section 055000 - METAL FABRICATIONS.
6. Section 078100 - APPLIED FIREPROOFING
7. Section 099000 - PAINTING AND COATING.

1.3 REFERENCES (LATEST EDITIONS)

- A. "Code of Standard Practice for Steel Buildings and Bridges" and "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" by the American Institute of Steel Construction.
- B. The second sentence in paragraph 4.2.1 of the "Code of Standard Practice for Steel Buildings and Bridges" is deleted under the provisions of this Specification.
- C. The "Seismic Provisions for Structural Steel Buildings" by the American Institute of Steel Construction, Inc.
- D. The "Connections Manual of Steel Construction" by the American Institute of Steel Construction, Inc.
- E. The "Specifications for Structural Joints Using High-Strength Bolts – 2009" by the Research Council on Structural Connections (RCSC).
- F. "Structural Welding Code - Steel" by the American Welding Society.
- G. ASTM listed standards by the American Society for Testing and Materials.
- H. SSPC listed standards by the Steel Structures Painting Council.
- I. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- J. When compliance with any such References is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.4 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES. One set of printed shop drawings shall be delivered to the Structural Engineer within 24 hours of submitting the electronic version of those shop drawings.

- B. Before starting the work of the Shop and Erection Drawings, the steel fabricator shall have their representatives contact the Architect and arrange to meet with the Architect and Structural Engineer to discuss connection details, schedules, shop procedures, materials, and other concerns related to structural steel work.
 - C. Prior to preparation of Shop Drawings, the fabricator shall submit typical details of all structural steel and Architecturally Exposed Structural Steel connection types including, but not limited to, moment connections, beam to column and beam to girder connections, arch connections, column splices, beam splices, bracing and hanger details, etc., for approval by the Architect and Structural Engineer. Design of all connections is to be provided by the fabricator, under the supervision of a registered, professional structural engineer, registered in the state that the project is located in.
 - D. Prior to submission of Shop Drawings, Contractor shall verify all dimensions, site conditions, etc., relating to existing conditions. Any discrepancies which affect the structural design or details shall be brought to the attention of the Architect and Structural Engineer.
 - E. No variance from design sizes and details will be permitted on submitted Shop Drawings, but requests for modification of connection type or details to better suit their shop practice, or for any other reasons, will be considered by the Architect and Structural Engineer.
 - F. Shop Drawings shall include all information required for fabrication of the component parts of the structure. Erection drawings shall clearly indicate all AESS members. They shall indicate size and weight of members, surface preparation, type and location of shop and field connections, the type, size and extent of all welds. Identify grinding, finish and profile of welds. The welding symbols used on the Shop Drawings shall be as adopted by the American Welding Society. Identify type, size finish and length of bolts, distinguishing between shop and field bolts. Indicate direction of bolt head orientation at connections for all AESS members.
 - G. Approval of Shop Drawings shall be for size and arrangement of principal and auxiliary members and for strength of connections. Any errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.
 - H. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.
 - I. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 – ELECTRONIC RELEASE FORM.
 - J. Reports: Submit certified copies of mill test reports for all structural steel furnished.
 - K. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order.
- 1.5 MOCKUPS
- A. At least four (4) weeks prior to fabricating AESS, the fabricator shall construct mockups to demonstrate aesthetic effects as well as the qualities of the materials and workmanship. Mockups of details shall include a representation of each type of exposed connection or built up member.

- B. Build mockups on site for review and approval by Architect. Mockups shall be full-size pieces, unless smaller models are approved by the Architect. Mockups may be part of the completed structure, as approved by the Architect.
 - 1. Obtain Architect's approval of mockups prior to fabrication of final units.
 - 2. Mockups shall have a finished surface, including surface preparation and paint/fire protection system.
- C. Retain and maintain mockups during construction in an undisturbed condition, as a standard for judging the completed AESS work.

1.6 QUALITY ASSURANCE

- A. Qualifications: The steel fabricator and erector conducting the work of this Section shall be AISC certified and experienced in fabricating AESS similar to that required for this project.
- B. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner.
- C. A qualified Testing Agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.
- D. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
- E. Inspection of welding work other than moment connections shall consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.
- F. Inspection of welding for work for moment connections shall be tested one hundred (100) percent either by ultrasonic or by radiography in accordance with the latest edition of the AWS Structural Welding Code. However, if, for an individual welder, the reject rate is demonstrated to be five (5) percent or less, the non-destructive testing rate may be reduced to twenty-five (25) percent for the individual welder. The evaluation of the welding shall be based on a sampling of at least forty (40) completed welds.
- G. Inspection of bolting work shall be in accordance with "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" by the American Institute of Steel Construction, latest edition. All bolting shall be visually inspected as directed by the Architect and Structural Engineer.
- H. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection.
- I. A final report shall be issued by the testing agency following the completion of work in this Section stating that all deficiencies have been corrected.

1.7 ALTERNATES

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of Section 012300 – ALTERNATES and the following conditions:
1. That request has been made and accepted prior to submission of Shop Drawings.
 2. That there is a substantial cost advantage or time advantage to the Owner.
 3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect, including cost reductions or savings in time to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Structural steel shapes shall comply with the requirements of ASTM A 992 or A 588 - Grade B (50 ksi minimum yield) for Structural Steel. Structural steel plates shall comply with ASTM A 36 (36 ksi minimum yield). Square or rectangular steel tubing shall comply with ASTM A 500 - Grade B (46 ksi minimum yield). Round steel tubing shall comply with ASTM A 500 - Grade B (42 ksi minimum yield).
- B. Bolts, nuts and washers shall comply with the requirements of ASTM A 325. Bolts shall be A 325N with washer.
- C. Anchor rods shall comply with the requirements of ASTM F 1554 – Grade 36, except F 1554 – Grade 105 at locations indicated on the Drawings. All anchor rods shall be headed type, with washer.
- D. Expansion bolts shall be Hilti Kwik Bolt TZ Expansion Anchors; Strong Bolt by Simpson Strong Tie; or Wedge Bolt by Powers Fastening Systems or an equal approved by the Architect.
- E. Epoxy injection anchor bolts shall be Hilti HIT Adhesive Anchors, ET with Set XP Epoxy Adhesive Anchors by Simpson Strong Tie, PE 1000 Epoxy Adhesive Anchor System by Powers Fastening Systems or an equal approved by the Architect. Use renovation screens when bolting to hollow substrate.
- F. Metallic Filler: Composition of 90% ground metal and 10% epoxy binder.

2.2 FABRICATION

- A. All structural steel shall be fabricated in accordance with References, approved Shop Drawings, and as hereinafter specified.
- B. All structural steel to remain exposed to view shall be fabricated in accordance with Chapter 10, Architecturally Exposed Structural Steel (AESS), in the AISC manual, unless more stringent requirements are specified herein. Continuously weld joints in AESS members. The welds shall be ground or otherwise treated as required to blend with adjacent parent metal. In addition, fabricate as follows:
1. Fabricate AESS with exposed surfaces smooth, square and of surface quality with the approved mockups. Use special care in handling and shipping AESS before and after shop painting.

2. Fabricator shall grind welds of AESS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within $+1/16"$ and $-0"$ of plate thickness.
 3. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one piece construction when primed. Grind and polish as required, to match profile on approved mockup.
 4. Where continuous welding is noted on the Drawings, provide uniform size and profile. All exposed welds shall be continuous, unless otherwise noted on the Drawings.
 5. Fabricate AESS members such that piece marks are fully hidden in the final structure or use media to permit full removal.
 6. Members specified to be rolled to a final curved shape shall be fully shaped in the shop and tied during shipping to prevent stress relieving. Distortion of the web or stem and of outstanding flanges of open sections shall be visibly acceptable to the Architect from a distance of 20 feet under any lighting condition.
 7. Seal weld open ends of rectangular hollow structural sections with $3/8"$ minimum closure plates.
- C. The design of members and connections for any portions of the structure not indicated on the Drawings shall be completed by the fabricator. Unless otherwise noted on the drawings, connections shall be capable of supporting the maximum uniform load of the member for the span shown and the material specified. Consideration must be given to the additional load carrying capacity of composite steel members. In general, and unless otherwise indicated, connections for composite beams shall be designed for at least 1.75 times the end reaction derived from the AISC uniform load beam tables for the particular beam and span. Connections for girders which support other beams should be designed for at least 1.5 times the AISC uniform load reaction. All connection design shall be subject to approval by the Architect and Structural Engineer.
- D. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.
- E. All shop connections shall be welded or bolted.
- F. Weld and joint details shall comply with requirements of the "Structural Welding Code - Steel" by the American Welding Society.
- G. Bolting shall comply with the requirements of AISC "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
- H. All field connections shall be bolted, except where welding is indicated on the Drawings. All field bolts shall be alternate design type tension control with twist off elements.
- I. Diameter of holes in bolted parts shall be $1/16"$ greater than the nominal diameter of the bolt. No unfair holes will be accepted, and enlargement of holes shall not be accomplished by burning. Burrs resulting from drilling or punching shall be ground to the surface of the material. Shearing and punching shall be done cleanly so as not to deform or mar adjacent surfaces.

- J. Provide holes and connections as required for site assembly of steel work. Holes shall be drilled or punched and reamed in the shop. Show sizes and locations of all such holes on the Shop Drawings.
- K. Provide angles, bars, etc. as necessary for deck support at columns where members do not frame in from all four sides and where connections interfere with the support of metal decking.
- L. Provide angles, channels, etc. around all openings in roof deck at drains, fans, etc. as shown in drawings. Coordinate size, number, and location with architectural, mechanical, electrical, and plumbing trades.
- M. In general, beam to beam, and beam to column connections shall be double angle type connections, unless otherwise shown on the Drawings.

2.3 SURFACE PREPARATION AND PROTECTIVE COATINGS

- A. All structural steel shall be cleaned of all scale, rust, grease and other foreign matter.
- B. Surface preparation for interior structural steel not exposed to view shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning"; steel shall be left unprimed.
- C. Surface preparation for interior structural steel exposed to view and all exterior structural steel shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 6, Commercial Blast Cleaning".
- D. Primer for interior structural steel that will remain exposed to view and is not scheduled to be fireproofed shall be "TNEMEC" Series 10-09 (gray) Primer, or equivalent as approved by the Architect.
- E. Primer for structural steel that will remain exposed to view and is scheduled to be fireproofed with intumescent paint shall be Albi 490W by the Albi Manufacturing Company, or equivalent as approved by the Architect.
- F. Primer for exterior structural steel that will remain exposed to view and is not scheduled to be galvanized or fireproofed, shall be "TNEMEC" 90G-1K97 TNEME-ZINC (greenish -gray) Primer.
- G. Where primer is required on steel members, omit the primer at the following locations:
 - 1. Surfaces embedded in concrete.
 - 2. Surfaces to be field welded.
 - 3. Surfaces at slip-critical connections.
 - 4. The tops of steel beams where deck and/or shear studs are to be welded.
 - 5. Surfaces to be spray fireproofed.
- H. Primer shall be applied in accordance with manufacturer's instruction to provide a minimum dry film thickness of 3.0 to 3.5 mils. Use priming methods that result in full coverage of joints, corners, edges and exposed surfaces.

- I. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field as required under Section 07 81 00 APPLIED FIREPROOFING Section 09 90 00 PAINTING AND COATING.
- J. Primer paint shall be applied in accordance with manufacturer's directions to ensure no running or sagging.
- K. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

2.4 GALVANIZING

- A. All steel items noted on the Drawings to be galvanized shall be galvanized by the hot dip process conforming to ASTM A 123 with the addition of nickel to zinc bath. All galvanizing shall be done after fabrication. All galvanized material to be painted shall be primed by the galvanizer within twelve hours after galvanizing and shall be force cured in a facility capable of maintaining 150 degrees F. All hot dip galvanized steel shall be safeguarded against embrittlement according to ASTM A 143.
- B. The galvanizer shall inspect all members for compliance with this Specification, and shall mark each member with a stamp indicating the ASTM number and the weight of the zinc coating in ounces per square foot.

PART 3 – EXECUTION

3.1 STORAGE AND HANDLING

- A. Care and protection shall be given to all structural steel during handling and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground. Care shall be taken to avoid abrasions and other damage.

3.2 ERECTION

- A. All structural steel shall be anchored and erected in accordance with References, approved Shop Drawings, and as hereinafter specified.
- B. All structural steel to remain exposed to view shall be erected in accordance with Chapter 10 Architecturally Exposed Structural Steel, in the AISC manual, unless more stringent requirements are specified herein.
 - 1. Grind all field welds of AESS smooth. For groove welds, the welds shall be made flush to the surfaces each side and be within +1/16" and -0" of plate thickness.
 - 2. Remove spatter and grind where necessary for blending. Contour surfaces to match those surfaces that are adjacent. Form fillets to the smallest radii possible and still comply with the structural requirements. Provide additional metallic filler to form smooth continuous surfaces that will appear as one-piece construction when primed. Grind and polish as required, to match profile on approved mockup.
 - 3. Where continuous welding is noted on the Drawings, provide uniform size and profile. All exposed welds shall be continuous, unless otherwise noted on the Drawings.
 - 4. Bolt heads shall be oriented as shown on the approved Shop Drawings.

5. Run-out tabs, angles, erection bolts and other steel members added to connections to allow for alignment, fit-up and welding in the field shall be removed from the structure. Remove backer bars, fill all "rat" holes and grind smooth at groove welded joints. Fill or plug weld holes for temporary erection bolts and grind smooth. All areas shall be touched up with the appropriate shop primer.
 6. Splice members only as approved on the submitted Shop Drawings.
- C. All work shall be accurately set to established lines and elevations and rigidly fastened in place with suitable attachments to the construction of the building.
 - D. Temporary bracing, guying, and support shall be provided to keep the structure safe and aligned at all times during construction, and to prevent danger to persons and property. Check all temporary loads and stay within safe capacity of all building components.
 - E. Except as otherwise indicated on the Drawings, all field connections shall be bolted in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts". All bolts shall be fully tensioned. Use not less than one (1) washer placed under the turning part of the assembly. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
 - F. The initial installations of expansion bolts and epoxy injection anchor bolts shall be witnessed by the manufacturer's representative and load tests shall be performed to test their adequacy.
 - G. Do not cut or alter any member in the field without Architect's written approval for each specific condition.
 - H. Welding, as indicated on the Drawings, shall be in accordance with References and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.
 - I. After erection, all structural steel members and connections shall be touched up with the appropriate primer.
 - J. Prior to field welding of any galvanized steel element, galvanizing in the general area to be welded must be removed by grinding.
 - K. All galvanized steel elements shall be touched up with a zinc-rich paint at areas scarred by welding or bolting.
- 3.3 SURVEY
- A. Engage the services of a licensed Engineer or Surveyor to survey elevations and locations of all column and arch bases, prior to start of erection of structural steel. Any discrepancies shall be brought to the attention of the Architect. Erection shall not proceed until any required remedial measures have been completed.
 - B. Upon completion of the building frame provide a survey of perimeter building columns that indicates the plan deviation (as applicable) from the column grid in each direction.

3.4 TOLERANCES

- A. Individual structural steel members shall be plumbed, leveled, and aligned in accordance with the requirements of Chapter 7 of the "Code of Standard Practice for Steel Buildings and Bridges", except as follows:
1. All tolerances (rolling, fabrication, erection, etc.) combined shall result in a framing in the complete structure being located within $\frac{3}{4}$ inches of its theoretical location, except that members at connections to columns shall be within $\frac{1}{8}$ inch vertically of their theoretical elevations.
 2. Tolerances for Architecturally Exposed Structural Steel (AESS) shall not exceed one-half those permitted for structural steel.

END OF SECTION 051200

SECTION 051226
SHEAR CONNECTORS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Work Included: The work of this Section consists of furnishing and installing all shear connectors as shown on the Drawings and as specified herein and includes, but is not limited to the following:
 - 1. Headed shear connectors.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 - Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
- C. Related Work: Related work shall be performed under the following Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING.
 - 3. Section 053100 - STEEL DECKING.

1.3 REFERENCES (LATEST EDITIONS)

- A. "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction.
- B. "Structural Welding Code - Steel" by the American Welding Society.
- C. ASTM listed standards by the American Society for Testing and Materials.
- D. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.

- E. When compliance with such References is specified for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator, certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.4 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES.
- B. Shop Drawings shall indicate size and position of all shear connectors. Shop Drawings shall indicate fastening methods for connectors.
- C. Approval of Shop Drawings will be for size and arrangement of shear connectors. Errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.
- D. Purchasing of any materials or performing any work prior to the final approval of Shop Drawings will be entirely at the risk of the Contractor.
- E. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for us as Shop and Coordination Drawings is subject to the requirements of Section 011401 – ELECTRONIC RELEASE FORM.

1.5 QUALITY ASSURANCE

- A. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner.
- B. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of it by the Owner or Architect, if defects are discovered.
- C. A minimum of two (2) shear connector studs shall be welded at the start of each production period to determine proper settings for the generator, control unit, and stud welder. These studs shall be capable of being bent 45 degrees from vertical without weld failure. If, after welding, visual inspection reveals that a sound, full 360 degree weld has not been achieved for any particular stud, that stud shall be struck with a hammer and bent approximately 15 degrees from vertical towards the nearest end of the beam, or bent away from the opening in the fillet weld. Studs meeting this test shall be considered acceptable and shall be left in this position. Studs failing under this test shall be replaced.
- D. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection.
- E. A final report shall be issued by the testing agency following the completion of the work of this Section.

PART 2 – PRODUCTS

2.1 MATERIALS

- A. All shear connector studs shall be made from cold drawn bar stock conforming to the requirements of ASTM A 108, Grades 1015 through 1020, either semi- or fully- killed. See drawings for lengths and diameter.
- B. Tensile requirements of shear connector studs, as determined by tests (ASTM A 370) of bar stock after drawing, or of full diameter finished studs, at the manufacturer's option, shall conform to the following:
 - 1. Tensile strength, (psi) minimum: 60,000
 - 2. Elongation in 2 inches, (%) minimum: 20
 - 3. Reduction in area, (%) minimum: 50
- C. Studs shall be of uniform diameter; heads shall be concentric and normal to shaft; and the weld shall be chamfered and solid fluxed. Studs shall not be painted or galvanized.

PART 3 - EXECUTION

3.1 STORAGE

- A. Care and protection shall be given to all shear connectors during handling and storage. If connectors are to be stored prior to installation, they shall not be placed in contact with the ground and shall be protected from the elements and kept dry.

3.2 INSTALLATION

- A. Shear connector studs shall be installed by an automatic welding system, in the number and spacing shown on approved Shop Drawings and as herein specified.
- B. Steel in the area to which the stud is to be directly welded should be free of loose mill scale, heavy rust, dirt and paint. In addition, where studs are to be welded through metal deck, verify that no water has become entrapped between the beam and the deck, prior to welding studs.
- C. Studs should not be welded when the temperature falls below 10 degrees Fahrenheit, or when the surface is wet with rain or snow.
- D. All welding shall be in accordance with The Structural Welding Code.
- E. After welding, break off ceramic arc shields and dispose of them properly.

END OF SECTION 051226

SECTION 052100
STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials, and equipment necessary to the complete the work of this Section, including, but not limited to, the following:
 - 1. Deep-Longspan steel joists (DLH-Series).
 - 2. Bridging, anchors, extended ends, ceiling extensions, and special seats.
 - 3. Shop paint and field touch-up paint after erection.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 - Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
- C. Related Work: Related work shall be performed under the following Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING.
 - 2. Section 053100 - STEEL DECKING.
 - 3. Section 054000 - COLD-FORMED METAL FRAMING.
 - 4. Section 055000 - METAL FABRICATIONS.
 - 5. Section 099000 - PAINTING AND COATING.

1.3 REFERENCES (LATEST EDITIONS)

- A. Massachusetts State Building Code - Eighth Edition.
- B. "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders," by the Steel Joist Institute.
- C. "Structural Welding Code - Steel" by the American Welding Society.

- D. "Code of Standard Practice for Steel Buildings and Bridges" and "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings" by the American Institute of Steel Construction.
- E. ASTM listed standards by the American Society for Testing and Materials.
- F. SSPC listed standards by the Steel Structures Painting Council.
- G. In case of conflict between the Reference Standards and the Project Specification, the Project Specification shall govern. In the case of conflict between Reference Standards, the more stringent shall govern.
- H. When compliance with any Reference Standard is specified herein for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.4 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES.
- B. Shop drawings shall indicate type, number, sizes, details, and spacing of all members. Shop Drawings shall indicate fastening methods for joists, bridging, anchors and all other details for installation.
- C. Approval of Shop Drawings shall be for size and arrangement of principal and auxiliary members and for strength of connections. Any errors in dimensions shown on the Shop Drawings shall be the responsibility of the Contractor.
- D. Fabrication of any material or performing of any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.
- E. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 – ELECTRONIC RELEASE FORM.
- F. Reports: Submit certified copies of mill test reports for all structural steel furnished.
- G. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order.

1.5 QUALITY ASSURANCE

- A. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect or by the Testing Agency. However, such inspection, wherever conducted, shall not relieve Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, not shall the Testing Agency's acceptance of materials or workmanship prevent later rejection of it by the Owner or Architect if defects are discovered.
- B. A qualified Testing Agency for testing and inspection will be selected by the Owner and shall be paid directly by the Owner.

- C. Inspection of welding work shall consist of non-destructive spot testing done by visual, magnetic particle, radiographic or ultrasonic methods, whichever is most effective for joint to be tested.
- D. Inspection of bolting work shall be in accordance with "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" by the American Institute of Steel Construction, latest edition. All bolting shall be visually inspected as directed by the Architect and Structural Engineer.
- E. The Contractor shall give proper notice to Testing Agency, including notification of at least 24 hours prior to the time of concrete placement, and shall allow access and full facilities as required for this inspection.
- F. A final report shall be issued by the Testing Agency following the completion of work in this Section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All steel joists and accessories shall be formed of material in accordance with the Reference Standards. See Drawings for type, depth, and size.

2.2 FABRICATION

- A. All steel joists and accessories shall be fabricated in accordance with the Reference Standards, approved Shop Drawings, and as hereinafter specified.
- B. All steel joists and accessories shall be fabricated by a member of the Steel Joist Institute.
- C. All steel joists shall be fabricated with a standard camber unless noted otherwise.

2.3 PROTECTIVE COATING

- A. All items shall be cleaned of all scale, rust, weld slag and weld spatter and other foreign matter and be given one (1) shop coat of rust inhibitive paint, 1 mil dry film thickness, as approved by the Architect.
- B. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field under another Section as indicated on the Shop Drawings.
- C. After erection, all scarred areas shall be touched up with the same paint as the shop coat.

PART 3 – EXECUTION

3.1 STORAGE AND HANDLING

- A. Care and protection shall be given to all steel joists during handling and storage. If items are to be stored prior to installation, they shall not be placed in contact with the ground.

3.2 FABRICATION

- A. All steel joists shall be fabricated in accordance with Reference Standards, approved Shop Drawings, and as hereinafter specified.
- B. The design of members and connections for any portions of the structure not indicated on the Drawings shall be completed by the fabricator. Connections shall be capable of supporting the maximum uniform load of the member for the span shown and the material specified. All connection design shall be subject to approval by the Architect and Structural Engineer.
- C. Welding, as indicated on the Drawings, shall be in accordance with Reference Standards and shall be done only by experienced welders who have been qualified by tests as prescribed in AWS "Standard Qualifications Procedure" for the type of work required.

3.3 ERECTION

- A. All steel joists and accessories shall be installed in accordance with the Reference Standards, approved Shop Drawings, and as hereinafter specified.
- B. Steel joists shall be welded to steel supports with two (2) ¼" welds, each at least three (3) inches long.
- C. All bridging shall be installed in accordance with the Reference Specifications and as shown on the Drawings.
- D. Joists shall be permanently fastened to supports and all bridging and anchors completely installed before any construction loads (other than workmen) are placed on the joists.
- E. All field welding shall be in accordance with the Reference Standards and shall be done only by experienced welders who have previously been qualified by tests as prescribed in AWS "Standard Qualification Procedure" to perform the type of work required.

END OF SECTION 052100

SECTION 053100

STEEL DECKING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 – GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Coordinate with such trades to assure the steady progress of all work under the Contract.

1.2 DESCRIPTION OF WORK

- A. Work Included: The work of this Section consists of furnishing and installing all steel deck work as shown on the Drawings and as specified herein and includes, but is not limited to, the following:
 - 1. Steel roof deck.
 - 2. Acoustic steel roof deck.
 - 3. Steel floor deck.
 - 4. Roof deck accessories: finish strips, butt strips, ridge plates, valley plates, splice plates, side lap screws, sump pans, acoustical batts and rubber closures.
 - 5. Floor deck accessories: closures and pour stops.
 - 6. Field touch-up paint after erection.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 - Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
- C. Related Work: Related work shall be performed under the following Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING.
 - 3. Section 051226 - SHEAR CONNECTORS.
 - 4. Section 052100 - STEEL JOIST FRAMING.
 - 5. Section 054000 - COLD-FORMED METAL FRAMING.

1.3 REFERENCES (LATEST EDITIONS)

- A. "Basic Design Specifications for Steel Deck Construction" by the Steel Deck Institute.
- B. "Specifications for the Design of Light Gauge Cold Formed Structural Members" by the American Iron and Steel Institute.
- C. ASTM listed standards by the American Society for Testing and Materials.
- D. "Structural Welding Code - Steel" by the American Welding Society.
- E. In case of conflict between the References and the Project Specification, the Project Specification shall govern. In the case of conflict between References, the more stringent shall govern.
- F. When compliance with such References is specified for materials or a manufactured or fabricated product, the Contractor, if requested, shall furnish an affidavit from the manufacturer or fabricator, certifying that the materials or product delivered to the job meets the requirements specified. However, such certification shall not relieve the Contractor from the responsibility of complying with any added requirements specified herein.

1.4 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES.
- B. Shop Drawings shall indicate size and location of framing supports and the location, lengths, types, gauges, and markings of deck units. Shop Drawings shall indicate fastening methods for deck units, and the type of connections, welds or screws, and other items as hereinafter called for.
- C. Shop Drawings shall also show all accessories and methods of attachment to the building frame.
- D. Approval of Shop Drawings will be for size and arrangement of units and for strength of connections. Errors in dimensions shown on the shop drawings shall be the responsibility of the Contractor.
- E. Fabrication of any material or performing any work prior to the final approval of the Shop Drawings will be entirely at the risk of the Contractor.
- F. Reproduction of structural plans, sections and details, and any like information by reprographic or electronic methods for use as Shop and Coordination Drawings is subject to the requirements of Section 011401 – ELECTRONIC RELEASE FORM.
- G. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order.

1.5 QUALITY ASSURANCE

- A. All materials and workmanship under this Section shall be subject to inspection in the mill, shop or field by the Architect, or by qualified inspectors selected by the Architect and paid directly by the Owner. All deck fastening shall be visually inspected.

- B. However, such inspection, wherever conducted, shall not relieve the Contractor of his responsibility to furnish materials and workmanship in accordance with Contract requirements, nor shall inspector's acceptance of materials or workmanship prevent later rejection of same by the Owner or Architect if defects are discovered.
- C. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities as required for this inspection.
- D. A final report shall be issued by the testing agency following the completion of the work in this Section.

PART 2 - PRODUCTS

2.1 STEEL ROOF DECK

- A. Typical steel roof deck shall be formed of steel sheets conforming to ASTM A 653 Grade 33, with a minimum yield strength of 33,000 psi with nestable side lap. Galvanized coating shall conform to ASTM A 653 G 60. See Drawings for deck type, gauge and depth.
- B. Acoustic steel roof deck shall be cellular type and formed of steel sheets conforming to ASTM A 653 Grade 33 with a minimum yield strength of 33,000 psi with interlocking side lap and perforated bottom plate. Galvanized coating shall conform to ASTM A 653 G 60. Sound absorbing batts shall be inert non-organic mineral fiber and shall be placed in each cell prior to delivery to the job site. The minimum Noise Reduction Coefficient (NRC) shall be 0.85. The minimum Sound Absorption Coefficients for various frequencies shall be as follows (frequency (Hz)/coefficient): 125/0.40, 250/0.50, 500/0.85, 1000/0.90, 2000/0.75, and 4000/0.60. Refer to the Drawings for deck type, gauge and depth.
- C. Typical steel roof deck units shall be cut to required lengths so that end joints will occur over supporting members and be lapped a minimum of two (2) inches. Typical lengths shall extend over three (3) or more spans, where possible.
- D. Acoustic steel roof deck units shall be cut to required lengths so that end joints will butt over supporting members. Typical lengths shall extend over three (3) or more spans, where possible.
- E. Accessory steel sections shall be of the same material, gauge and finish as the steel deck units, unless otherwise indicated.
- F. Sump pans shall be recessed and not lighter than 14 gauge galvanized sheets. Size of the hole to be field cut to match the roof drain.
- G. Closures shall be flexible rubber to seal flutes.
- H. All exposed surfaces shall be shop primed and ready for job site finish painting.

2.2 STEEL FLOOR DECK

- A. Typical steel floor deck shall be formed of steel sheets conforming to ASTM Standard A 653 Grade 40 and shall be the composite type with 6" wide (nominal) flutes top and bottom sides at 12" on center, with a minimum yield strength of 40,000 psi. Galvanized coating shall conform to ASTM A 653 G 60. Refer to the Drawings for gauge and depth.

- B. Steel floor deck units shall be cut so that end joints will butt over supporting members. Typical lengths shall extend over three (3) or more spans where possible.
- C. Accessory steel sections shall be of the same material, gauge and finish as the steel deck units, unless otherwise indicated.
- D. Pour stops shall be not lighter than 18 gauge and be of the same material and finish as the steel deck units. Use heavier gauge where indicated on the Drawings.
- E. All exposed surfaces shall be shop primed and ready for job site finish painting.

2.3 PROTECTIVE COATINGS

- A. Steel deck units shall be cleaned of scale, rust, grease, oil or other foreign matter and be given a phosphate conversion coating. Acoustic steel deck shall then be shop coated with approved synthetic enamel primer and baked.
- B. Shop and field touch-up paint shall be compatible with paint to be used for finish painting in the field under the PAINTING Section.

PART 3 - EXECUTION

3.1 STORAGE

- A. Care and protection shall be given to all steel decking material during handling and storage. During unloading and hoisting, extra care shall be given to prevent damage to the ends, sides and distortion of the individual items. If items are to be stored prior to installation, they shall not be placed in contact with the ground.

3.2 INSTALLATION

- A. Deck shall be erected and fastened in accordance with manufacturer's specifications, approved Shop Drawings, and as hereinafter specified.
- B. Place steel deck units on supporting framework and adjust to final position with proper bearings, end and side laps before permanently securing work.
- C. Welds to steel supports shall be fusion type. Puddle welds shall be at least 5/8 inch diameter or an elongated weld having an equal perimeter.
- D. Typical steel roof deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at each rib.
 - 2. Intermediate supports: Welded at each rib.
 - 3. Longitudinal edges at marginal supports: Welded maximum spacing of twelve (12) inches.
 - 4. Side laps of adjacent units: Screw fastened between supports at intervals not exceeding twenty-four (24) inches.

- E. Acoustic steel roof deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at each rib.
 - 2. Intermediate supports: Welded at each rib.
 - 3. Longitudinal edges at marginal supports: Welded, maximum spacing of twelve (12) inches.
 - 4. Side laps of adjacent units: 1 ½" seem welds between supports at intervals not exceeding twenty-four (24) inches.

- F. Typical composite steel floor deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at each rib.
 - 2. Intermediate supports: Welded at each rib.
 - 3. Longitudinal edges at marginal supports: Welded, maximum spacing of twelve (12) inches.
 - 4. Side laps of adjacent units: button punched, maximum spacing of twenty four (30) inches.

- G. Fasten accessories to deck by welding.

- H. Holes and openings that are indicated on the Structural Drawings shall be cut by the deck erector. Coordinate locations with respective trades. Holes not so indicated, but which are required for work by other trades, shall be located and cut by the respective trades.

- I. All welding shall be in accordance with the References and shall be done only by experienced welders who have previously been qualified to perform the type of work required.

- J. After erection, all scarred areas of decking, including cuts, drill holes, rust spots, welds and weld scars, shall be touched up with a zinc-rich paint.

- K. Install rubber closures in all roof deck flutes over exterior walls.

- L. Provide field fabricated sheet closures at all perimeter and interior columns, breaks at perimeter pour stops, etc. as required for a complete job.

END OF SECTION

SECTION 054000

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Exterior non-load-bearing wall framing.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 055000 - METAL FABRICATIONS for masonry shelf angles and connections.
 2. Section 061600 - SHEATHING for exterior sheathing applied to cold-formed metal framing.
 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.
 4. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. **Delegated Design:** Design framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As required by code.
 2. Deflection Limits: Design framing systems to withstand design loads within deflections greater than the following:
 - a. Exterior Non-Load-Bearing Framing:
 - 1) Horizontal deflection of 1/240 of the wall height for metal panel systems.
 - 2) Horizontal deflection of 1/240 of the wall height for EIFS systems.

3) Horizontal deflection of 1/600 of the wall height for masonry systems.

3. 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 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load, plus superimposed dead load, deflection of primary building structure.

C. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the jurisdiction where Project is located responsible for their preparation.
- D. Delegated-Design Submittal: For framing indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Welding certificates.
- F. Qualification Data: For professional engineer.
- G. 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. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. 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, ductility, and metallic-coating thickness.
- D. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- 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. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, 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

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ClarkDietrich Building Systems.
 - 2. Consolidated Fabricators Corp.; Building Products Division.
 - 3. MarinoWARE; a division of Ware Industries.
 - 4. Super Stud Building Products Inc.

2.2 MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90 (Z275).

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (16 gauge).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ClarkDietrich Building Systems.
 - b. MarinoWARE, a division of Ware Industries.
 - c. The Steel Network, Inc.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.5 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, threaded carbon-steel bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
 - D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
 - E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
 - F. Welding Electrodes: Comply with AWS standards.
- 2.6 MISCELLANEOUS MATERIALS
- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035 or ASTM A 780.
 1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
 - C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
 - 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install cold-formed metal 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 metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
- 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 and control joints with cold-formed metal framing. Independently frame both sides of joints.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. Erection Tolerances: Install cold-formed metal 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.

3.4 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.**
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 FIELD QUALITY CONTROL

- A. Testing: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 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 metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 055000

METAL FABRICATIONS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.

1. Loose steel bearing and leveling plates, including bearing plates for steel joists, galvanized at exterior locations and in exterior walls.
2. Galvanized steel lintels with shop-applied primer at exterior locations.
3. Steel lintels with shop-applied zinc-rich primer at interior locations.
4. Galvanized shelf angles with shop applied primer at exterior locations.
5. Shelf angles with zinc-rich shop-applied primer at interior locations.
6. Steel elevator machine beams.
7. Steel support angles for elevator door sills.
8. Cants in elevator hoistways made from sheet steel.
9. Miscellaneous steel framing and supports:
 - a. Steel framing and supports with shop applied primer for operable partitions.
 - b. Galvanized steel framing and supports for overhead doors.
 - c. Steel pipe grid at Drama Labs.
 - d. Galvanized steel framing and supports for mechanical and electrical equipment.
 - e. Steel framing and supports for applications where framing and supports are not specified in other Sections; galvanized at exterior locations and in exterior walls.
 - f. Prefinished slotted steel channel support framing.
 - g. Steel framing and supports with shop-applied primer for countertops.
10. Ladders:
 - a. Steel ladders to all roof levels, galvanized at exterior locations.
 - b. Steel ladders at interior locations, shop-primed.
 - c. Steel ladder safety cages, galvanized at exterior locations.
 - d. Steel ships' ladders with shop-applied primer.
 - e. Steel elevator pit ladders.
 - f. Alternating tread devices.
11. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles, galvanized at exterior locations and in exterior walls.
12. Galvanized steel bollards with shop-applied primer.
13. Galvanized pipe guards with shop-applied primer.
14. Steel floor plate and frame.
15. Cast gray iron nosings.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for structural steel items.
 - 2. Section 055100 - METAL STAIRS AND RAILINGS for steel stairs, handrails, and guardrails.
 - 3. Section 055300 - METAL GRATINGS for metal bar gratings.
 - 4. Section 099000 - PAINTING AND COATING for field painting work of this section.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- B. Thermal Movements: Provide exterior metal fabrications 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 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

- A. Product Data: For the following:
 - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 - 2. Metal nosings and treads.
 - 3. Paint products.
 - 4. Grout.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer licensed in the jurisdiction where Project is located, responsible for their preparation.
4. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.

D. Welding certificates.

E. Qualification Data: For professional engineer.

F. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Delegated Design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal fabrications that are similar to those indicated for this Project in material, design, and extent.

C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

D. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. 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. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 at interior, Type 316L at exterior.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 at interior, Type 316L at exterior.
- E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- F. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
 - 1. Provide Schedule 80 pipe for bollards.
- H. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
- I. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

2.2 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209/B 209M, Alloy 6061-T6.
- B. Aluminum Extrusions: ASTM B 221/221M, Alloy 6063-T6.
- C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

- B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. 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.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.7 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.8 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
 - 1. Provide mitered and welded units at corners.
 - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts if units are installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.10 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
 - 2. For elevator pit ladders, comply with ASME A17.1.
 - 3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
 - 4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

2.11 LADDER SAFETY CAGES

- A. General:
 - 1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
 - 2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.

3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.

2.12 METAL SHIPS' LADDERS

- A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

2.13 ALTERNATING TREAD DEVICES

- A. Alternating Tread Devices: Fabricate alternating tread devices to comply with ICC's International Building Code. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

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. Lapeyre Stair Inc.
 - b. Precision Ladders, LLC.
 - c. Vestil Manufacturing Company.
2. Fabricate from steel and assemble by welding or with stainless-steel fasteners.
3. Comply with applicable railing requirements in Section 055100 - METAL STAIRS AND RAILINGS.

- B. Galvanize exterior steel alternating tread devices, including treads, railings, brackets, and fasteners.

2.14 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.15 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

2.16 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch-thick by 12-inch-wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

2.17 METAL FLOOR PLATE

- A. Fabricate from rolled-steel floor plate of minimum 1/4 inch steel unless thicker units are required for anticipated loadings.
- B. Include steel angle stiffeners, and fixed and removable sections as indicated.
- C. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.18 ABRASIVE METAL NOSINGS

- A. Cast-Metal Units: Cast gray iron, Class 20 with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
- B. Drill for mechanical anchors and countersink. Locate not more than 4 inches from ends and not more than 12 inches o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.
- C. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

2.19 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.20 STEEL PRIMERS AND FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Urethane Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
 - 3. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
 - 4. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 5. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."
- B. Zinc-Rich Primer: Urethane zinc rich primer compatible with topcoat Specified in Section 099000 - PAINTS AND COATINGS. Provide primer with a VOC content of 340 g/L (2.8 lb/gal.) or less per OTC and HAPS COMPLIANT STANDARDS PER 2007 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Perimerprime at 3.0 mils DFT or approved equal by DuPont or Carboline.

1. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.21 HOT-DIP GALVANIZING

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
1. Basis-of-Design: Duragalv by Duncan Galvanizing..
 2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
 3. Provide thickness of galvanizing specified in referenced standards.
 4. Galvanizing bath shall contain special high grade zinc and other earthy materials.
 5. Fill vent holes after galvanizing, if applicable, and grind smooth.

2.22 HOT-DIP GALVANIZING AND FACTORY-APPLIED PRIMER

- A. Hot-Dip Galvanizing: For steel exposed to the elements, weather or corrosive environments and other steel indicated to be galvanized, provide coating for iron and steel fabrications applied by the hot-dip process.
1. Basis-of-Design: Duragalv by Duncan Galvanizing.
 2. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware.
 3. Provide thickness of galvanizing specified in referenced standards.
 4. Galvanizing bath shall contain special high grade zinc and other earthy materials.
 5. Fill vent holes after galvanizing, if applicable, and grind smooth.
- B. Factory-Applied Primer over Galvanized Steel: Provide factory-applied prime coat, certified OTC/VOC compliant less than 2.8 lbs/gal. and conforming to EPA and local requirements. Apply primer within 12 hours after galvanizing at the same galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. Primer coat shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments. Blast cleaning of the surface is unacceptable for surface preparation. Primer shall have a minimum two year re-coat window for application of finish coat. Coatings must meet or exceed the following performance criteria as stipulated by the coatings manufacturer:
1. Basis-of-Design: Primergalv by Duncan Galvanizing.
 2. Abrasion Resistance: ASTM D 4060 (CS17 Wheel, 1,000 grams load).1kg load, 200 mg loss.
 3. Adhesion: ASTM D4541, 1050 psi.
 4. Corrosion Weathering: ASTM D5894, 13 cycles, 4,368 hours; rating 10 per ASTM D714 for blistering and rating 7 per ASTM D610 for rusting.
 5. Direct Impact Resistance: ASTM D2794, 160 in. lbs.
 6. Flexibility: Method: ASTM D522, 180 degree bend, 1 inch mandrel, passes.
 7. Pencil Hardness: ASTM D3363, 3B.
 8. Moisture Condensation Resistance: ASTM D4585, 100 degrees F, 2000 hours; passes, no cracking or delamination.
 9. Dry Heat Resistance: Method: ASTM D2485, 250 degrees F.
 10. Warranty: Provide galvanizer's warranty that materials will be free from 10 percent or more visible rust for a period of 20 years.

2.23 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.24 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

- F. Corrosion Protection: Coat concealed surfaces of steel that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, 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 nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.4 INSTALLING PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.5 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

- A. Center nosings on tread widths.
- B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.
- C. Seal thresholds exposed to exterior with elastomeric sealant complying with Section 079200 - JOINT SEALANTS to provide a watertight installation.

3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.
 - 1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have 95 percent zinc by weight, ZiRP by Duncan Galvanizing. Thickness of applied

- galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable..
2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel for warranties to apply. Touch-up shall be such that repair is not visible from a distance of 6 feet. If non factory-approved technicians are used for field touch-up, no warranties shall exist.
 3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

SECTION 055100

METAL STAIRS AND RAILINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Preassembled steel stairs with concrete filled treads.
 2. Steel tube railings, interior and exterior.
 3. Steel tube handrails, interior and exterior.
 4. Steel tube guardrails, interior and exterior.
 5. Steel mesh infill panels.
 6. Stainless-steel ornamental railings.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 055000 - METAL FABRICATIONS for metal treads and nosings not installed in metal stairs.
 2. Section 057300 - DECORATIVE METAL RAILINGS for, stainless steel railings.
 3. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.
 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.
 5. Section 099000 - PAINTING AND COATING for field painting work of this section.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design stairs and railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load and Concentrated Loads: As required by Code.
 - 2. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 3. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch, whichever is less.
- C. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and Code required loads and stresses within limits and under conditions indicated.
- D. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to Code.

1.4 SUBMITTALS

- A. Product Data: For metal stairs and the following:
 - 1. Site-filled metal-pan stair treads.
 - 2. Paint products.
 - 3. Grout.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. 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.
 - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, licensed in the jurisdiction where Project is located, responsible for their preparation.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
 - 1. Preassembled Stairs: Commercial class.
 - 2. Industrial-Type Stairs: Industrial class.
 - 3. Ornamental Stairs: Architectural class.
- C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."
3. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.6 COORDINATION

- A. 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.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- D. Steel Bars for Grating Treads: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- E. Wire Rod for Grating Crossbars: ASTM A 510.
- F. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- G. Uncoated, Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M either commercial steel, Type B, or structural steel, Grade 30, unless another grade is required by design loads.
- H. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.
- I. Wire Mesh, Carbon Steel: ASTM A 510.

2.3 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304 at interior locations and 316L at exterior locations.
- B. Pipe: ASTM A 312, Grade TP 304 at interior locations and 316L at exterior locations.

- C. Castings: ASTM A 743, Grade CF 8 or CF 20.
- D. Plate and Sheet: ASTM A 666, Type 304 at interior locations and 316L at exterior locations.

2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

2.5 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 099000 - PAINTING AND COATING.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- F. Concrete Materials and Properties: Comply with requirements in Section 033000 - CAST-IN-PLACE CONCRETE for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.6 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.
 - 3. Fabricate treads and platforms of exterior stairs so finished walking surfaces slope to drain.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

- E. Form exposed work true to line and level 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 and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- 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. Comply with "Guideline 1: Joint Finishes", by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:
 - 1. Typical Railing: Type 2 or better, unless otherwise indicated.
 - 2. Service Stair Railing: Type 3 or better, unless otherwise indicated.
 - 3. Ornamental Railing: Type 1.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.7 STEEL-FRAMED STAIRS

- A. Available Manufacturers:
 - 1. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
- B. Stair Framing:
 - 1. Fabricate stringers of steel plates or channels. Provide closures for exposed ends of stringers.
 - 2. Construct platforms of steel plate or channel headers and miscellaneous framing members as needed to comply with performance requirements.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board or shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.
 - 5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal-Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements but not less than 0.0677 inch.
 - 1. Steel Sheet: Uncoated hot-rolled steel sheet, unless otherwise indicated.

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. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.8 STEEL TUBE RAILINGS

- A. General: 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.
- B. 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.
- C. Form changes in direction of railings as detailed on the Drawings.
- D. 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.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. 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.
- G. Brackets, Flanges, Fittings, and Anchors: Provide custom wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Provide as shown on drawings. 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 galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.9 WIRE MESH INFILL PANELS

- A. 2" x 2" steel mesh, .187 inch diameter for interior, and .25 inch diameter for exterior. Steel mesh shall be framed in U-shaped steel channels.

2.10 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.

2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 - 3. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
 - 4. Handrails: Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1 inch straight line on the surface of the railings.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed products:
 - 1. Interior Stairs (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

2.12 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.

- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- F. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 - CAST-IN-PLACE CONCRETE.
 - 1. Install abrasive nosings with anchors fully embedded in concrete. Center nosings on tread width.

3.2 INSTALLING STEEL TUBE 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. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
 - 1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
 - 2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 3. For hollow masonry anchorage, use toggle bolts.
 - 4. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

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- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 055300

METAL GRATINGS

(Part of Work of Section 050001 - MISCELLANEOUS AND ORNAMENTAL IRON, Trade Bid Required)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal bar gratings at stairs and catwalks.
 - 2. Metal frames and supports for gratings.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Sleeves, anchors, inserts, plates and similar items.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Miscellaneous metal and iron sleeves, anchors, inserts and plates to be built into masonry walls.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING for structural-steel framing system components.
 - 2. Section 055100 - METAL STAIRS AND RAILINGS for stairs fabricated with metal bar grating treads and platforms

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design gratings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated.

1. Floors: Uniform load of 250 lbf/sq. ft. or concentrated load of 3000 lbf, whichever produces the greater stress.
2. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. or concentrated load of 8000 lbf, whichever produces the greater stress.
3. Limit deflection to L/360 or 1/4 inch, whichever is less.

- C. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

- A. Product Data: For the following:

1. Formed-metal plank gratings.
2. Extruded-aluminum plank gratings.
3. Glass-fiber-reinforced plastic gratings.
4. Clips and anchorage devices for gratings.
5. Paint products.

- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

- C. Shop Drawings: Include plans, sections, details, and attachments to other work.

- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- E. Qualification Data: For qualified professional engineer.

- F. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

- G. Welding certificates.

- H. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

- A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual" and NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual."

- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for gratings, grating frames, and supports. 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.

PART 2 - PRODUCTS

2.1 FERROUS METALS

- A. **Recycled Content of Steel Products:** Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Bars for Bar Gratings: ASTM A 36/A 36M or steel strip, ASTM A 1011/A 1011M or ASTM A 1018/A 1018M.
- D. Wire Rod for Bar Grating Crossbars: ASTM A 510.
- E. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30.
- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33, with G90 coating.
- G. Expanded-Metal Carbon Steel: ASTM F 1267, Class 1.
- H. Expanded-Metal Galvanized Steel: ASTM F 1267, Class 2, Grade A.

2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless steel fasteners for fastening stainless steel.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Plain Washers: Round, ASME B18.22.1.

- E. Lock Washers: Helical, spring type, ASME B18.21.1.
- 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 E 488, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.
- B. Shop Primers: Provide primers that comply with Section 099000 - PAINTING AND COATING.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Provide interior, field-applied primer with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 1. Provide interior, field-applied paint with a VOC content of 250 g/L or less, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FABRICATION

- A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch material 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.
- C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.
- D. Fit exposed connections accurately together to form hairline joints.
- E. Welding: Comply with AWS recommendations and 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.

- F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.
 - 1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
 - 2. Fabricate toeplates for attaching in the field.
 - 3. Toeplate Height: 4 inches unless otherwise indicated.

2.5 METAL BAR GRATINGS

- 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. Alabama Metal Industries Corporation; a Gibraltar Industries company.
 - 2. Fisher & Ludlow; Division of Harris Steel Limited.
 - 3. IKG Industries; a division of Harsco Corporation.
 - 4. Ohio Gratings, Inc.
- B. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.
- C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.
 - 1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.
- D. Do not notch bearing bars at supports to maintain elevation.

2.6 GRATING FRAMES AND SUPPORTS

- A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.
 - 1. Unless otherwise indicated, fabricate from same basic metal as gratings.
 - 2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

2.7 STEEL FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish gratings, frames, and supports after assembly.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings 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 gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.
- D. Fit exposed connections accurately together to form hairline joints.
 1. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Attach toeplates to gratings by welding at locations indicated.
- F. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
- G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

3.2 INSTALLING METAL BAR GRATINGS

- A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.
- B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.
- C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 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 requirements for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 061000
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood blocking, cants, and nailers.
 - 2. Plywood backing panels.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for wood nailers and blocking built into masonry.
 - 2. Section 061600 - SHEATHING for plywood and gypsum sheathing.
 - 3. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork not specified in this Section.
 - 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for sheet metal backing.

1.3 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, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Certified Wood: Provide a 100 percent of the wood-based materials and products certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria.
- B. Low-Emitting Materials, Adhesives and Sealants: Materials used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the following requirements.
 1. Adhesives, Sealants, and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.
- C. Low-Emitting Materials, Field-Applied Paints and Coatings: Paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the VOC limits and must not include any of the chemical components limited or restricted by the following standards.
 1. Architectural Paints, Coatings and Primers: Green Seal GS-11, Paints, First Edition May 20, 1993. For applications on walls and ceilings.
 2. Clear Wood Finishes, Floor Coatings, Stains, and Shellacs: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings, rules in effect on January 1, 2004.
- D. Low-Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and agrifiber products used inside the exterior weatherproofing system shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

1.5 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 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."
- B. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. 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.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
 - 4. Provide dry lumber with 15 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- C. Plywood Panels:
 - 1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 - 2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
 - 3. Factory mark panels according to indicated standard.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with the ground, 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. 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 material after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark each treated item with the treatment quality mark of an inspection agency approved by the American Lumber Standards Committee Board of Review.
- 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 in exterior walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For all interior use materials, provide materials that are fire-retardant treated and comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber and ASTM D 5516, for plywood.
 2. Use treatment that does not promote corrosion of metal fasteners.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including the following:
1. Rooftop equipment bases and support curbs.
 2. Blocking.
 3. Cants.
 4. Nailers.
 5. Furring.
 6. Grounds.
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 15 percent moisture content.

2.5 PANEL PRODUCTS

- A. Miscellaneous Concealed Plywood: Exposure 1 sheathing, span rating to suit framing in each location, and thickness as indicated but not less than 1/2 inch.
- B. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2 inch thick.

2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Wire, Brads, and Staples: FS FF-N-105.
- C. Power-Driven Fasteners: CABO NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

- F. Bolts: Steel bolts complying with ASTM A 307, Grade A with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.7 MISCELLANEOUS MATERIALS

- A. Adhesive, Including Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Use adhesives that have a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit 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.
- C. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.
- D. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
- E. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.
- F. Use fasteners of appropriate type and length. Pre-drill members when necessary to avoid splitting wood.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION

SECTION 061600

SHEATHING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Gypsum sheathing attached to cold-formed metal framing members at exterior wall.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry-veneer anchors and insulation in cavity wall construction.
 - 2. Section 054000 - COLD-FORMED METAL FRAMING for metal framing at exterior wall.
 - 3. Section 061000 - ROUGH CARPENTRY for plywood backing panels.
 - 4. Section 072700 - AIR BARRIERS for modified bituminous sheet membrane over gypsum sheathing and membrane flashing.
 - 5. Section 076200 - SHEET METAL FLASHING AND TRIM for flashing applied to gypsum sheathing.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology Standard: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum sheathing board construction not defined in this Section or in other referenced standards.

1.4 SUBMITTALS

- A. Product Data: For each product specified.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each gypsum sheathing product through one source from a single manufacturer.

- B. Fire-Resistance-Rated Assemblies: Where gypsum sheathing boards are part of fire-resistance-rated assemblies, provide assemblies as follows:
 - 1. Assemblies comply with requirements of fire-response-tested assemblies indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual"; or by design designations in UL's "Fire Resistance Directory" or in certification listings of another testing and inspecting agency acceptable to authorities having jurisdiction.
 - 2. Fire-resistance ratings were determined by fire-response testing assemblies according to ASTM E 119.
- C. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles, each bearing brand name and identification of manufacturer.
- B. Store materials protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, or other causes. Neatly stack gypsum sheathing board flat on leveled supports off the ground, under cover, and fully protected from weather.

1.7 SEQUENCING AND SCHEDULING

- A. Sequence installing sheathing with installing exterior cladding to comply with requirements indicated below:
 - 1. Do not leave glass-mat gypsum sheathing board exposed to weather for more than 180 days.

PART 2 - PRODUCTS

2.1 SHEATHING BOARD

- A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; GlasRoc.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond, e²XP.
 - d. USG Corporation; Securock.
 - 2. Type and Thickness: 5/8 inch, Type X.

2.2 FASTENERS

- A. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Vertical Installation: Install 48-inch- wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud:
 1. Perimeter: 6 inches on center.
 2. Field: 8 inches on center.

END OF SECTION

SECTION 064020

INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior standing and running trim and wall caps.
2. Plastic-laminate casework.
3. Display cases.
4. Plastic-laminate countertops.
5. Epoxy countertops and sinks.
6. Epoxy pegboards (drying boards).
7. Closet shelving.
8. Laboratory accessories.
9. Steel supports for interior woodwork including but not limited to counter support brackets.
10. Shop finishing of interior woodwork.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.

- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Division 26 – ELECTRICAL for wiring to light fixtures in display cases and for power and data outlets in custom desks.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified, including cabinet hardware and accessories, and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018113.
 2. Show percentage of product that is FSC-certified wood. Provide backup documentation as described in Section 018113.
 3. Show installed costs for all items listed.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
 3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- D. Samples for Verification:
 1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.
 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
 3. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with 1/2 of exposed surface finished.
 4. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
 5. Epoxy surfacing, 8 by 10 inches.
- E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- F. Qualification Data: For Installer and fabricator.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Certified Wood: Provide a 100 percent of the wood-based materials and products certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria.
- B. Low-Emitting Materials, Adhesives and Sealants: Materials used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the following requirements.
 1. Adhesives, Sealants, and Sealant Primers: Comply with the testing and product requirements of Scientific Certification System's (SCS's) Indoor Advantage Gold program or GreenGuard's Children and Schools program.
 2. Aerosol Adhesives: Comply with the testing and product requirements of Scientific Certification System's (SCS's) Indoor Advantage Gold program or GreenGuard's Children and

Schools program.

- C. Low-Emitting Materials, Field-Applied Paints and Coatings: Paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the VOC limits and must not include any of the chemical components limited or restricted by the following standards.
 - 1. Architectural Paints, Coatings and Primers: Comply with the testing and product requirements of Scientific Certification System's (SCS's) Indoor Advantage Gold program or GreenGuard's Children and Schools program.
 - 2. Clear Wood Finishes, Floor Coatings, Stains, and Shellacs: Comply with the testing and product requirements of Scientific Certification System's (SCS's) Indoor Advantage Gold program or GreenGuard's Children and Schools program.
- D. Low-Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and agrifiber products used inside the exterior weatherproofing system shall contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

1.5 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. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.
- D. 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.
 - 1. Provide AWI Quality Certification Program labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.
- E. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- F. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC's "Principles and Criteria for Forest Stewardship."
- G. 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.

- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 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.

1.7 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. 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.

1.8 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

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: Select Clear Quarter Sawn Maple, typical.
- C. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no added urea formaldehyde.
 - 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 4. Softwood Plywood: DOC PS 1, Medium Density Overlay.

5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
 6. Softwood Plywood: DOC PS 1, Medium Density Overlay.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Nevamar Company, LLC; Decorative Products Div.
- E. Epoxy Resin Material: As specified herein below.
- F. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, with exposed edges seamed before tempering, 6 mm thick, unless otherwise indicated.
- G. Tempered Float Glass for Cabinet Shelves: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3; with exposed edges seamed before tempering, 6 mm thick.

2.2 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.
1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
 2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
 3. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to

achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

2.3 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.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011; 4" wire pulls.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: [BHMA A156.9, B04071; with shelf rests, B04081] [BHMA A156.9, B04102; with shelf brackets, B04112].
 - 1. Standards with brackets for installation in display cases:
 - a. Standards: 304 stainless steel standard with brushed finish, 7/8 inch wide; RAKKS, or equal.
 - b. Brackets for narrow shelves up to 8 inches wide: 12-gauge cold-rolled steel with electro-zinc-plated and clear lacquered finish, with polyamide resin lock lever; RAKKS Shelf Bracket with Anochrome Finish, or equal.
 - c. Brackets for wide shelves 12 to 18 inches wide: 12-gauge cold-rolled steel with electro-zinc-plated and clear lacquered finish, with polyamide resin lock lever; RAKKS Shelf Bracket with Anochrome Finish, or equal.
- F. Drawer Slides: Provide Accuride 3640, or approved equal. BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:
 - 1. Box Drawer Slides: Grade 1.
 - 2. File Drawer Slides: Grade 1HD-100.
 - 3. Pencil Drawer Slides: Grade 2.
 - 4. Keyboard Slides: Grade 1.
 - 5. Trash Bin Slides: Grade 1HD-100.
- G. Display Case Hardware: Provide chrome top and bottom pivots, and locks for glass doors in display cases.
 - 1. Hinge: Sugatsune XL-GC 04, or approved equal.
 - 2. Lock: CR Laurence Co., EH90; or approved equal.
- H. Display Case Lighting: Refer to electrical drawings.
- I. Display Case Shelf Supports: Provide adjustable shelf supports with recessed standards to accommodate glass shelf spans.
 - 1. Product: 523 – EPCO as manufactured by Engineered Products Co.; or approved equal.
- J. Door Locks: BHMA A156.11, E07121.

1. General: Provide a lock for each door and drawer in custom casework. All keys in a given room shall be keyed alike.
 2. Cam Locks for Cabinet Doors and Drawers: 5-disc tumbler locks, die-cast construction with nickel plate finish, hex nut mounted, 5/8-inch cylinder length with cam assembled to lock; National Cabinet Locks, M4-0054 with M4-7054 Remove-a-Core, or equal.
 3. Pin Tumbler Lock for Sliding Glass Doors: Die-cast, aluminum and steel construction pin tumbler lock designed for installation on sliding glass doors: National Cabinet Locks, M2-0225-001 or NO-0252-002 as required, or equal.
- K. Drawer Locks: BHMA A156.11, E07041.
- L. Grommets for Cable Passage through Countertops: Molded-plastic oval shaped grommets and matching plastic caps with slot for wire passage.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.
 2. Satin Aluminum, Clear Anodized: BHMA 628.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- O. Chain stops: Provide chain door stops for all cabinet doors as required to prevent doors from coming in contact with adjacent construction.
- P. Clothes rods: Provide stainless steel clothes rods and mounting brackets.
- Q. Grilles: Manufactured pencil-proof aluminum linear bar diffusers with baked enamel finish, for installation in tops and bottoms of enclosures for fin-tube radiation.
1. Core: Fixed, evenly spaced, extruded aluminum, tee-shaped bars, 0° deflection, spaced at 7/16 inch o.c. with perpendicular support bar; width as required to accommodate 3-inch duct; Titus, Model CT-PP-0, or equal.
 2. Frame and Border: Heavy-gauge, extruded aluminum trim at perimeter of core designed to frame and support core in place, with spring latch; Titus, Frame & Border Type 4, or equal.
 3. Insulation: Refer to Section 072100 – THERMAL INSULATION, for rigid insulation to be secured to back of base cabinet in cavity with fin-tube radiation between cabinet and exterior wall.
- 2.4 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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: Comply with the testing and product requirements of Scientific Certification System's (SCS's) Indoor Advantage Gold program or GreenGuard's Children and Schools program.
- E. Provide articulating, pivoting keyboard trays with mouse pads for installation below counters where indicated.
- F. Counter and Bench Supports: Fabricate counter and bench support brackets to support weight of counter or bench, plus an additional 500 lbs. concentrated load located to create greatest stress. Drill brackets for anchor bolts and fasteners.
- G. Laboratory Accessories: Provide pegboards, experimental beam accessories in Physics, and where indicated.

2.5 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. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- D. 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.
- E. 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.
 - 1. Seal edges of openings in countertops with a coat of varnish.
- F. Counter Supports: Fabricate counter support brackets to support weight of counter or bench, plus an additional 500 lbs. concentrated load located to create greatest stress. Drill brackets for anchor bolts and fasteners.

2.6 INTERIOR STANDING AND RUNNING TRIM, BASE, AND MOULDINGS FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated.

1. 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 wider than available lumber, use veneered construction. Do not glue for width.
 - D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.
 - E. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
 - F. Assemble casings in plant except where limitations of access to place of installation require field assembly.
 - G. Wood Caps: Provide low wall wood caps in profiles and configurations indicated on drawings.
 1. 3/4" veneer construction with 3/4" thick by 1-1/2" tall solid edge.
 2. Finish: Transparent.
- 2.7 PLASTIC-LAMINATE CASEWORK
- A. Grade: Custom.
 - B. AWI Type of Casework Construction: Flush overlay.
 - C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade HGS.
 4. Edges: Grade HGS.
 - D. Materials for Semiexposed Surfaces:
 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
 2. Drawer Sides and Backs: Solid-hardwood lumber.
 3. Drawer Bottoms: Hardwood plywood.
 - E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
 - F. 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.

2.8 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. 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 manufacturer's full range.
- D. Edge Treatment: PVC – T-moulding in color as selected by Architect.
- E. Core Material: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.9 EPOXY COUNTERTOP, PEGBOARD, AND SINK MATERIALS

- A. Epoxy Countertops and Sinks:
 - 1. Durcon Company, Inc. (The).
 - 2. Epoxyn Products.
 - 3. Laboratory Tops, Inc.
- B. Epoxy Resin for Countertops, Pegboards and Sinks: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 1. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi (70 MPa).
 - b. Modulus of Elasticity: Not less than 2,000,000 psi (1400 MPa).
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.02 percent.
 - e. Heat Distortion Point: Not less than 260 deg F (127 deg C).
 - 2. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
 - 3. Color: As selected by Architect.
- C. Resin Work Tops: Provide front overhang of 1-inch, with continuous drip groove on underside 1/2 inch from edge.
 - 1. Work Top Material: Solid epoxy composition.
 - 2. Work Top Configuration: Raised (marine) edge, 1-1/4 inches thick at raised edge, with beveled edge and corners.

2.10 CLOSET SHELVING

- A. Grade: Custom.
- B. Shelf Material: 3/4-inch (veneer-faced panel product with solid-lumber edge).
- C. Cleats: 3/4-inch 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.

2.11 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.
- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. All woodwork shall receive transparent finish unless specifically indicated otherwise on the drawings.
- D. 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 paneling 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.
- E. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:
 - 1. Grade: Custom.
 - 2. AWI Finish System TR-4: Conversion varnish.
 - 3. Staining: Match approved sample for color.
 - 4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 6. Sheen: Semigloss, 55-75 gloss units.

PART 3 - EXECUTION

3.1 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.

3.2 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.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. 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.
- G. 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 60 inches 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 plastic wood filler, sand smooth, and finish same as wood base if finished.
 - 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
 - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- H. 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 sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
- I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
 - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
 - 4. Calk space between backsplash and wall with sealant specified in Section 079200 - JOINT SEALANTS.

- J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- K. Provide joint sealant for joints between work of this section and adjacent construction. Joint sealant materials and procedures shall comply with section 079200 – Joint Sealants.

3.3 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, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 066400
PLASTIC PANELING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work of this Section includes but is not limited to:
 - 1. Glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood furring for installing plastic paneling.
 - 2. Section 102600 - WALL AND DOOR PROTECTION for corner guards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Low-Emitting Materials, Adhesives and Sealants: Materials used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the following requirements.
1. Adhesives, Sealants, and Sealant Primers: South Coast Air Quality Management District (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.
- B. Low-Emitting Materials, Field-Applied Paints and Coatings: Paints and coatings used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) must not exceed the VOC limits and must not include any of the chemical components limited or restricted by the following standards.
1. Architectural Paints, Coatings and Primers: Green Seal GS-11, Paints, First Edition May 20, 1993. For applications on walls and ceilings.
 2. Clear Wood Finishes, Floor Coatings, Stains, and Shellacs: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings, rules in effect on January 1, 2004.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC SHEET PANELING

- A. General: Gelcoat-finished, glass-fiber reinforced plastic (FRP) panels complying with ASTM D 5319.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Composites.
 - b. Marlite.
 - c. Nudo Products, Inc.
 2. Nominal Thickness: Not less than 0.075 inch.
 3. Surface Finish: Molded pebble texture.
 4. Color: As selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Adhesive: As recommended by plastic paneling manufacturer.
 - 1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."
 - 1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels and so that trimmed panels at corners are not less than 12 inches wide.

1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 070001

WATERPROOFING, DAMPPROOFING AND CAULKING

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF SUB-BIDDER: (Insert name of sub-bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

SUB-BID FOR SECTION: 070001 – WATERPROOFING, DAMPPROOFING
AND CAULKING.

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: ((always insert accurate list of sheet numbers of applicable Drawings)).

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 071100 - BITUMINOUS DAMPPROOFING
 2. All Work of Section 071300 - SELF-ADHERING SHEET WATERPROOFING
 3. All Work of Section 071400 - FLUID-APPLIED WATERPROOFING
 4. All Work of Section 071610 - CRYSTALLINE WATERPROOFING
 5. All Work of Section 072700 - AIR BARRIERS
 6. All Work of Section 079200 - JOINT SEALANTS

END OF SECTION

SECTION 070002

ROOFING AND FLASHING

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Division of Capital Asset Management at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 070002 - ROOFING AND FLASHING

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
To be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. All Work of Section 075400 - THERMOPLASTIC MEMBRANE ROOFING
 2. All Work of Section 076200 - SHEET METAL FLASHING AND TRIM

END OF SECTION

SECTION 070800
COMMISSIONING OF BUILDING ASSEMBLIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. OPR and BoD documentation are included by reference for information only.
- C. The Commissioning Plan.

1.02 SUMMARY

- A. This Section includes general requirements that apply to implementation of the commissioning process without regard to specific systems, assemblies, and components.
- B. Commissioning of the building assemblies is focused on thermal and moisture integrity of the envelope.
- C. Related Sections include the following:
 - 1. Division 01 Section 019113 General Commissioning Requirements for general commissioning process activities.
 - 2. Divisions 2 through 9
 - 3. The Building Commissioning Plan

1.03 DEFINITIONS

- A. Commissioning Plan: A document, prepared by CxA, that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. This Plan is included in Volume 4 of these specifications.
- B. CxA: Commissioning Authority.
- C. Quality Assurance: A program for the systematic monitoring and evaluation of the various aspects of a system, assembly, or component to ensure that standards of quality are being met. This is the responsibility of the CxA.
- D. Quality Control: A system for ensuring the maintenance of proper standards in systems, assemblies, and components. This is the responsibility of the Contractor.
- E. Official: State or Local official having jurisdiction over the building assembly systems
- F. Systems, Assemblies, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, equipment, and components.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 COMMISSIONING AUTHORITY'S DUTIES

- A. Cooperate with the Architect and Contractor and provide qualified personnel when scheduled.
- B. Promptly notify Architect and Contractor of irregularities or deficiencies in work that are observed during performance of services.
- C. Be present to observe all testing of all building exterior enclosure systems as defined in the Contract Documents.
- D. Commissioning Authority is not authorized to:
 - 1. Release, revoke, alter or expand requirements of Contract Documents.
 - 2. Approve or accept any portion of the work.
 - 3. Perform any duties of the Contractor.

3.02 TESTING VERIFICATION

At substantial completion of the project,

- A. The General Contractor is to:
 - 1. Certify that building exterior enclosure systems, subsystems, and construction have been completed according to the Contract Documents, including all addenda and change order requirements.
 - 2. Certify that Field Quality Control procedures have been completed, and that field quality control reports have been submitted, discrepancies corrected, and corrective work approved. Provide a copy of the list of non-conformances maintained by the General Contractor indicating all rework and corrections completed.
- B. The Commissioning Authority is to:
 - 1. Verify that Field Quality Control procedures have been completed, and that field quality control reports have been submitted, discrepancies corrected, and corrective work approved.
 - 2. Annotate checklist or data sheets when a deficiency is observed.
 - 3. Verify that field quality-control testing of building exterior enclosure has been completed and approved. The Commissioning Authority shall observe and document field quality-control tests and inspections.

3.03 DEFERRED TESTING:

- A. If field tests cannot be completed because of a deficiency outside the scope of the Building Exterior Enclosure, the deficiency shall be documented and reported to the Owner and the

Architect-of-Record. Deficiencies shall be resolved and corrected by appropriate parties and the test rescheduled.

3.04 TESTING REPORTS:

- A. Testing reports shall include measured data, data sheets, and a comprehensive summary describing the specific building exterior enclosure systems at the time of testing.
- B. Prepare a preliminary test report. Deficiencies will be evaluated by the Architect and the Commissioning Authority building exterior enclosure commissioning sub-consultant to determine corrective action. Deficiencies shall be corrected and test repeated. All repairs are to be documented by the Commissioning Authority.
- C. If it is determined that the system is constructed according to the Contract Documents, the Owner will decide whether modifications are required to bring the performance of the system to a level where the failure or deficiency is eliminated and shall be implemented or if the test results will be accepted as submitted. If corrective Work is performed, the Owner will decide if tests shall be repeated and a revised report is to be submitted.

3.05 SYSTEMS TO BE COMMISSIONED

- A. Refer to Divisions 2 through 9 of the Specification Sections for specific requirements for commissioning each building exterior enclosure element and system. The systems and elements to be commissioned include, but are not limited to:
 - 1. Roof system, including all penetrations, transitions, etc.
 - 2. Skylights and other sloped glazing
 - 3. Exterior walls, including the air barrier system, and water management systems
 - 4. Windows
 - 5. Doors, louvers
 - 6. Sealants and expansion joints
 - 7. Flashings, including all transitions, end-dams, etc.
 - 8. Shading devices
 - 9. Curtain walls or window walls, storefront
 - 10. Below-grade construction, including drainage and waterproofing/damp proofing
 - 11. Infrared scan of roof
 - 12. Infrared scan of envelope

3.06 SAMPLE DOCUMENTATION

S A M P L E
Installation Checklist
Aluminum Construction
(Entrances, Vestibules, Curtain walls, Storefronts, Windows, Glazing)

Schedule ID# from drawings:
Reference Specification: **084000**
Reference Drawing: **Various**

Location: **Exterior walls**

Model Verification

	Specified	Submitted	Installed
Manufacturer			
Model Number			

Installation Checks:

ID	Description	Pass	Fail	Comments
1	Verify material finish matches approved samples and that color matches between panels and parts are within the specified range.	<input type="checkbox"/>	<input type="checkbox"/>	
2	Verify material is clean and free of dents, scratches, burrs, & blemishes.	<input type="checkbox"/>	<input type="checkbox"/>	
3	Verify components or pre-assembled panels are checked for shipping damage after uncrating; and size, shape, thickness of metal extrusions or parts match full size details when available.	<input type="checkbox"/>	<input type="checkbox"/>	
4	Verify that a mock up was built and approved.	<input type="checkbox"/>	<input type="checkbox"/>	
5	Verify that system joints are tight and sealed as required.	<input type="checkbox"/>	<input type="checkbox"/>	
6	Verify weep holes and drainage systems are provided and are clean before and after erection.	<input type="checkbox"/>	<input type="checkbox"/>	
7	Verify assembled system dimensional tolerances are maintained, that the system is plumb and within horizontal and vertical alignment.	<input type="checkbox"/>	<input type="checkbox"/>	
8	Verify proper glazing is installed. (Tempered, tinted, low E, insulated, etc.).	<input type="checkbox"/>	<input type="checkbox"/>	
9	Verify system exposed flashing is properly installed with flat appearance and without visible deflection.	<input type="checkbox"/>	<input type="checkbox"/>	
10	Verify sill flashing is set in continuous bead of sealant and sill anchorage screws are covered with sealant.	<input type="checkbox"/>	<input type="checkbox"/>	
11	Verify sealants and primers are those approved and that have passed the pre-construction sealant tests.	<input type="checkbox"/>	<input type="checkbox"/>	
12	Verify that dissimilar metals are isolated to protect against galvanic action	<input type="checkbox"/>	<input type="checkbox"/>	
13	Verify that where aluminum contacts concrete or masonry, that contact surfaces are painted with bituminous paint.	<input type="checkbox"/>	<input type="checkbox"/>	
14	Verify expansion joints are provided between units as required.	<input type="checkbox"/>	<input type="checkbox"/>	
15	Verify sealant joints are located as required; and are neat, uniform and are not wider than detailed.	<input type="checkbox"/>	<input type="checkbox"/>	
16	Verify field-applied sealant is of proper type and color and applied where required.	<input type="checkbox"/>	<input type="checkbox"/>	
17	Verify reveals are of consistent size and alignment.	<input type="checkbox"/>	<input type="checkbox"/>	
18	Verify electric or pneumatic outlets and locations, if required, are coordinated and provided.	<input type="checkbox"/>	<input type="checkbox"/>	
19	Verify flashings are installed as detailed and as coordinated with window/curtain wall manufacturer.	<input type="checkbox"/>	<input type="checkbox"/>	

20	Verify anchorage to structure is secure for transfer of wind load.	<input type="checkbox"/>	<input type="checkbox"/>	
21	Verify door and operable window hardware provisions have been coordinated.	<input type="checkbox"/>	<input type="checkbox"/>	
22	Obtain manufacturer's touch-up painting procedures	<input type="checkbox"/>	<input type="checkbox"/>	
23	Field water test thresholds, flashings, end dams.	<input type="checkbox"/>	<input type="checkbox"/>	

Approvals	Name (printed neatly)	Signature	Date
Construction Manager or GC			
Installing Contractor			

S A M P L E

Functional Performance Test
Building Envelope - Curtain Wall: Air & Water Infiltration Test

1. Participants

	<u>Name</u>	<u>Representing (Company)</u>
Commissioning Agent (CxA):	_____	_____
Sealant contractor:	_____	_____
Glazing contractor:	_____	_____
General contractor:	_____	_____
Owner's Representative:	_____	_____

Party filling out this form and witnessing testing: _____

Date of test: _____

2. Test Prerequisites

a. ___ The building envelop construction checklists have been submitted and approved indicating that the contractors are ready for functional testing of:

- Location: _____ Elevation _____ Floor _____ From grid line _____ to grid line _____
- Location: _____ Elevation _____ Floor _____ From grid line _____ to grid line _____
- Location: _____ Elevation _____ Floor _____ From grid line _____ to grid line _____
- Location: _____ Elevation _____ Floor _____ From grid line _____ to grid line _____

b. ___ All A/E punch list items for these sections of the fenestration system have been corrected.

c. ___ This functional test procedure has been reviewed and agreed to by installing contractors.

d. ___ Testing shall be performed per the Testing Schedule (attached).

e. ___ Equipment required for access has been coordinated with test schedule.

f. ___ Water connection for hose is available and has adequate pressure required for test.

g. ___ If area to be tested has previously failed testing Form C-6 (Commissioning Corrective Action Report) has been completed by contractor indicating corrections are complete and system is ready for retesting.

3. Verification of Associated Construction Checks.

Associated construction checklist and reports for systems being functionally tested are successfully completed? Y/N

Testing Schedule:

Seq. ID	Mode ID	Test Procedure [including special conditions]	Expected and Actual Response [Write ACTUAL response in brackets or circle]	Pas s Y/N	Note #
1	ALUMINUM CURTAIN WALL / STORE FRONT WATER INFILTRATION TESTS	<ol style="list-style-type: none"> Field test installed fenestration components as directed by CxA in accordance with ASTM 1105-96 <u>Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform or Cyclic Static Air Pressure Difference</u>. The ASTM 1105 test shall be conducted at an air pressure difference of 6.24 lbs/ft². The exact locations of each test site will be determined in the field by the Architect, per the project manual. 	No water leakage.		
2	WATER INFILTRATION TESTS (FIXED WINDOW)	<ol style="list-style-type: none"> Field test installed fenestration components as directed by CxA in accordance with AAMA 501.2-03 (Hose Test) <u>Method of Test for Exterior Walls. Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Curtain Walls and Doors</u>. The exact locations of each test site will be determined in the field by the Architect, per the project manual. 	No water leakage.		

END OF TEST

END OF SECTION 070800

SECTION 071100

BITUMINOUS DAMPPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Cold-applied, emulsified-asphalt dampproofing applied to the following surfaces:
 - a. Exterior, below-grade surfaces of concrete and masonry foundation walls.
 - b. Back side of concrete and masonry retaining walls, below grade.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 071300 - SELF-ADHERING SHEET WATERPROOFING for membrane waterproofing.
 - 2. Section 071610 - CRYSTALLINE WATERPROOFING for crystalline waterproofing.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Material Certificates: For each product, signed by manufacturers.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt 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 thoroughly cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Euclid Chemical Company.
 - 2. Henry Company.
 - 3. Karnak Corporation.
 - 4. Meadows, W. R., Inc.
 - 5. Sonneborn, Degussa Building Products.
 - 6. Tremco Inc.

2.2 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Emulsified-Asphalt Dampproofing, Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 MISCELLANEOUS MATERIALS

- A. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.
- B. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.
- C. Patching Compound: Manufacturer's fibered mastic of type recommended by dampproofing manufacturer.
- D. Protection Course: Multi-ply semi-rigid core composed of a mineral-fortified asphalt core formed between two outside layers of asphalt impregnated reinforced mats, manufactured in accordance with ASTM D 6506, 1/8 inch or 1/4 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.
 - 1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Protection of Other Work: 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 work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.
- C. Apply patching compound for filling and patching tie holes, honeycombs, reveals, and other imperfections.

3.3 APPLICATION

- A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.
 - 1. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated.
 - 2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.
 - 3. 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.
 - 4. Extend 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 5. 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 required for embedding fabric is in addition to other coats required.
- B. On 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.
- C. On Backs of Concrete and Masonry Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft.

3.4 INSTALLATION OF PROTECTION COURSE

- A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course. Support protection course with spot application of trowel-grade mastic where not otherwise indicated.

3.5 CLEANING

- A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION

SECTION 071300

SELF-ADHERING SHEET WATERPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rubberized-asphalt sheet waterproofing.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 072100 - THERMAL INSULATION for insulation at foundations and under slabs.
 - 2. Section 079200 - JOINT SEALANTS for joint-sealant materials and installation.
 - 3. Section 079500 - EXPANSION CONTROL for expansion-joint systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1. Include Setting Drawings showing layout, sizes, sections, profiles, and joint details of concrete pavers with paver support assemblies.
- D. Samples: For the following products:
1. 12-by-12-inch square of waterproofing and flashing sheet.
 2. 4-by-4-inch square of drainage panel.
- E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Store rolls according to manufacturer's written instructions.
- E. Protect stored materials from direct sunlight.
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.
 - 1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch in width.
 - 2. Warranty Period: Five years after date of Substantial Completion.
 - 3. Warranty includes removing and reinstalling protection board, drainage panels, and insulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Rubberized-Asphalt Sheet Waterproofing - Post-Applied:
 - a. American Hydrotech, Inc.; VM 75.
 - b. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; CCW MiraDRI 860/861.
 - c. Cetco; Envirosheet.
 - d. W. R. Grace & Co.; Bituthene 3000.
 - e. W. R. Meadows, Inc.; Mel-Rol.

2.2 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- A. Rubberized-Asphalt Sheet: 60-mil-thick, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated to a 4-mil-thick, polyethylene film with release liner on adhesive side.
 - 1. Physical Properties: As follows, measured per standard test methods referenced:
 - a. Tensile Strength: 325 psi minimum; ASTM D 412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F ASTM D 1970.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (movement; ASTM C 836.
 - e. Puncture Resistance: 50 lbf minimum; ASTM E 154.
 - f. Hydrostatic-Head Resistance: 200 feet (minimum; ASTM D 5385.
 - g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
 - h. Vapor Permeance: 0.05 perms; ASTM E 96, Water Method.

2.3 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

- B. Primer: Liquid primer recommended for substrate by manufacturer of sheet waterproofing material.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.
- D. Sheet Strips: Self-adhering, rubberized-asphalt composite sheet strips of same material and thickness as sheet waterproofing.
- E. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.
- F. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.
- G. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
 - 1. Detail Tape: Two-sided, pressure-sensitive, self-adhering reinforced tape, 4-1/2 inches wide, with a tack-free protective adhesive coating on one side and release film on self-adhering side.
- H. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch thick, predrilled at 9-inch centers.
- I. Protection Course: Fan-folded, extruded-polystyrene board insulation, unfaced, nominal thickness 3/8 inch.

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side and a polymeric film bonded to the other side of a 3-dimensional, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Sure-Drain V.
 - b. W. R. Grace Hydroduct 220 vertical – 660 horizontal
 - c. Miradri Miradrain 6200 or 6200XL
 - d. Tremco Inc. TREMDrain 1000 or TREMDrain 2000

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 - 1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.

2. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, and sound; ready to receive HDPE sheet.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- F. Bridge and cover isolation joints, expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips.
 1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
 - a. At footing-to-wall intersections, extend liquid membrane each direction from corner or install membrane strip centered over corner.
 - b. At plaza deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 RUBBERIZED-ASPHALT SHEET APPLICATION

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams and stagger end laps to ensure watertight installation.

1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, rubberized-asphalt sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F .
- D. Horizontal Application: Apply sheets from low point to high point of decks to ensure that side laps shed water.
- E. Apply continuous sheets over sheet strips bridging substrate cracks, construction, and contraction joints.
- F. Seal exposed edges of sheets at terminations not concealed by metal counterflashings or ending in reglets with mastic or sealant.
- G. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing as applicable.
- H. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheets extending 6 inches beyond repaired areas in all directions.
- I. Correct deficiencies in or remove sheet waterproofing that does not comply with requirements, repair substrates, reapply waterproofing, and repair sheet flashings.

3.4 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 1. For vertical applications, install board insulation before installing drainage panels.

3.5 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 2. Flood each area for 24 hours.
 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
- B. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.6 PROTECTION AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.

- C. Protect installed insulation from damage due to ultraviolet light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 071400

FLUID-APPLIED WATERPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Rubberized-asphalt waterproofing membrane, reinforced.
 - 2. Molded-sheet drainage panels.
 - 3. Plaza deck pavers.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 071300 - SELF-ADHERING SHEET WATERPROOFING for foundation and underslab waterproofing.
 - 2. Section 072100 - THERMAL INSULATION for insulation at foundations and under slabs.
 - 3. Section 079200 - JOINT SEALANTS for joint-sealant materials and installation.
 - 4. Section 079500 - EXPANSION CONTROL for expansion-joint systems.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.
- D. Samples: For the following products:
1. 12-by-12-inch square of waterproofing and flashing sheet.
 2. 4-by-4-inch square of drainage panel.
 3. Plaza deck paver, full sized in each color and texture required.
 4. Paver pedestal assembly.
- E. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.
- F. Sample Warranty: Copy of special waterproofing manufacturer's and Installer's warranty stating obligations, remedies, limitations, and exclusions before starting waterproofing.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer who is acceptable to waterproofing manufacturer to install manufacturer's products.
- B. Source Limitations: Obtain waterproofing materials, protection course, and molded-sheet drainage panels through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review requirements for waterproofing, including surface preparation specified under other Sections, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver liquid materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
- C. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- D. Protect stored materials from direct sunlight.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate, or when temperature is below 0 deg F.
1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.
1. Warranty insulation will retain 80 percent of original published thermal value.
 2. Warranty pavers will not dish or warp and will not crack, split, or disintegrate in freeze-thaw conditions.
 3. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.
 4. Warranty Period: **Five** years from date of Substantial Completion.
- B. Special Installer's Warranty: Signed by Installer, covering Work of this Section, for warranty period of **two** years.
1. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pedestal-mounted pavers on plaza decks.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane:
 - a. American Hydrotech, Inc.; Monolithic Membrane 6125.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW-500R.
 - c. Henry Company; 790-11.
 - d. Siplast, equal product.
 - e. Tremco Incorporated; Tremproof 150.

2.2 WATERPROOFING MEMBRANE

- A. Hot Fluid-Applied, Rubberized-Asphalt Waterproofing Membrane: Single component; 100 percent solids; hot fluid-applied, rubberized asphalt.
- B. Physical Properties:

PROPERTY	TEST METHOD	TYPICAL RESULTS
Flash Point	ASTM D-92, CGSB-37.50-M89	500°F*
Low Temperature Crack Bridging Capability	CGSB-37.50-M89	No cracking, adhesion loss, or splitting
Water Vapor Permeability	ASTM E 96, Procedure E, CGSB-37.50-M89	1.6ng/Pa(s)M ² , (0.018 perm)
Water Resistance (5 days/50 °C)	CGSB-37.50-M89	No delamination, blistering, emulsification, or deterioration
Water Absorption	CGSB-37.50-M89	0.22g weight gain
Toughness	CGSB-37.50-M89	13.0 Joules
Ratio of Toughness to Peak Load	CGSB-37.50-M89	0.069
Viscosity	CGSB-37.50-M89	7.0 seconds
Heat Stability	CGSB-37.50-M89	No change in viscosity, penetration,

Low Temperature Flexibility (- 25 °C)	CGSB-37.50-M89	flow or low temperature flexibility No delamination, flexibility adhesion loss, or cracking
Penetration	ASTM D 1191, CGSB-37.50-M89	75.0 mm at 77°F, 121.7mm at 122 °F
Flow	ASTM D 1191, GSB-37.50-M89	0.0mm @ 140°F
Softening Point	ASTM D 36	180°F
Elongation	ASTM D 1191	1000% minimum
Resiliency	ASTM D 3407	40% minimum
Bond to Concrete @ 0 °F, (18 °C)	ASTM D 3408	Pass
Hydrostatic Pressure Resistance	ASTM D-08.22, Draft 2 ASTM D 896 Procedure 7.1• (N- 8)	100 psi (=231 foot head of water) Pass 50% Nitric Acid, 50% Sulfuric Acid
Acid Resistance		
Salt Water Resistance (20% sodium carbonate and cal- cium chloride)	ASTM D-896 similar	No delamination, blistering, emulsification, or deterioration

*45°F more than the application temperature recommended by the manufacturer.

2.3 FLASHING SHEET MATERIALS

A. Elastomeric Flashing Sheet: 50-mil-minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

2.4 AUXILIARY MATERIALS

A. Primer: ASTM D 41, asphaltic primer.

B. Elastomeric Sheet: 50-mil-minimum, uncured sheet neoprene as follows:

1. Tensile Strength: 1400 psi minimum; ASTM D 412, Die C.
2. Elongation: 300 percent minimum; ASTM D 412.
3. Tear Resistance: 125 psi minimum; ASTM D 624, Die C.
4. Brittleness: Does not break at minus 30 deg F; ASTM D 2137.

C. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum termination bars; approximately 1 by 1/8 inch thick; with anchors.

D. Sealants and Accessories: Manufacturer's recommended sealants and accessories.

E. Reinforcing Fabric: Manufacturer's recommended, spun-bonded polyester fabric equal to "Flex-Flash Reinforcement" by American Hydrotech, complying with the following:

1. Unit Weight: 1.35 oz./sq.yd per ASTM D 1910.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Manufactured composite subsurface drainage panels consisting of a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to 1 side and a

polymeric film bonded to the other side of a 3-dimensional, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft.

2.6 PLAZA DECK PAVERS

- A. Plaza Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza deck pavers; minimum compressive strength 7500 psi ASTM C 140; absorption not greater than 5 percent, ASTM C 140; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C 67; and as follows:
1. Size: Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch in length, height, and thickness.
 2. Colors and Textures: As indicated by manufacturer's designations
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hanover Architectural Products, Inc.
 - b. Hastings Pavement Co., Inc.
 - c. Roofblok, Ltd.
 - d. Wausau Tile, Inc.; Terra-Paving Div.
 - e. Westile Roofing Products.
- B. Paver Supports: Paver manufacturer's standard SBR rubber, HDPE, or polyurethane paver support assembly, including adjustable or stackable pedestals, shims, and spacer tabs for joint spacing of 1/8 to 3/16 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
 2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- E. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.

3.3 JOINTS, CRACKS, AND TERMINATIONS

- A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.
 - 1. Rout and fill joints and cracks in substrate. Before filling, remove dust and dirt according to ASTM D 4258.
 - 2. Adhere strip of elastomeric sheet to substrate in a layer of hot rubberized asphalt. Extend elastomeric sheet a minimum of 6 inches on each side of moving joints and cracks or joints and cracks exceeding 1/8 inch thick, and beyond deck drains and penetrations. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.
 - 3. Embed strip of reinforcing fabric into a layer of hot rubberized asphalt. Extend reinforcing fabric a minimum of 6 inches on each side of nonmoving joints and cracks not exceeding 1/8 inch thick, and beyond roof drains and penetrations.
 - a. Apply second layer of hot fluid-applied, rubberized asphalt over reinforcing fabric.

3.4 FLASHING INSTALLATION

- A. Install elastomeric flashing sheets at terminations of waterproofing membrane according to manufacturer's written instructions.
- B. Prime substrate with asphalt primer.
- C. Install elastomeric flashing sheet and adhere to deck and wall substrates in a layer of hot rubberized asphalt.
- D. Extend elastomeric flashing sheet up walls or parapets a minimum of 8 inches (200 mm) above plaza deck pavers and 6 inches (150 mm) onto deck to be waterproofed.
- E. Install termination bars and mechanically fasten to top of elastomeric flashing sheet at terminations and perimeter of roofing.

3.5 MEMBRANE APPLICATION

- A. Apply primer, at manufacturer's recommended rate, over prepared substrate and allow to dry.
- B. Heat and apply rubberized asphalt according to manufacturer's written instructions.
 - 1. Heat rubberized asphalt in an oil- or air-jacketed melter with mechanical agitator specifically designed for heating rubberized asphalt.
- C. Start application with manufacturer's authorized representative present.
- D. Reinforced Membrane: Apply hot rubberized asphalt to substrates and adjoining surfaces indicated. Spread to a thickness of 90 mils (2.3 mm); embed reinforcing fabric, overlapping sheets 2 inches (50 mm); spread another 125-mil- (3.2-mm-) thick layer to provide a uniform, reinforced, seamless membrane 215 mils (5.5 mm) thick.
- E. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.

3.6 MOLDED-SHEET DRAINAGE PANEL INSTALLATION

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate according to manufacturer's written instructions. Use methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.

3.7 PLAZA DECK PAVER INSTALLATION

- A. Install concrete pavers and paver supports in locations indicated according to manufacturer's written instructions.
- B. Accurately install adjustable height pedestals and other accessories to elevations required. Adjust for final level and slope with shims.
- C. Loosely lay pavers on pedestals, maintaining a uniform open joint width. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
 - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.
- E. Maintain tolerances of paving installation within 1/4 inch in 10 feet of surface plane in any direction.

3.8 FIELD QUALITY CONTROL

- A. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing waterproofing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - 1. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
 - 2. Flood each area for 24 hours.
 - 3. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.
- B. Engage an independent testing agency to observe flood testing and examine underside of decks and terminations for evidence of leaks during flood testing.

3.9 CLEANING AND PROTECTION

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

omr architects inc.
AUGUST 15, 2012

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END OF SECTION

SECTION 071610

CRYSTALLINE WATERPROOFING

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. Crystalline waterproofing for the following applications.
 - a. Elevator pits.
 - b. Sump pits.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

- 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete substrate and finishing concrete walls and slabs to receive waterproofing.
- 2. Section 042000 - UNIT MASONRY for preparing concrete unit masonry walls to receive waterproofing.
- 3. Section 079200 - JOINT SEALANTS for elastomeric and preformed sealants in concrete and masonry walls and floors.

1.3 SUBMITTALS

- A. Product Data: Include construction details, and material descriptions and installation instructions for crystalline waterproofing.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions and warranty requirements.
- B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.
- C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F or above during work and cure period, and space is well ventilated and kept free of water.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of crystalline waterproofing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to maintain watertight conditions within specified warranty period.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crystalline Waterproofing:
 - a. Anti-Hydro International, Inc.; Hydro Cap.
 - b. Conproco Corp.; Super Seal.
 - c. Tamms Industries, Inc.; Hey'Di K-11.
 - d. ThoRoc, Div. of ChemRex; Tegraproof.
 - e. Vandex International Ltd.; Vandex Super.
 - f. Xypex Chemical Corporation; Xypex.

2.2 MATERIALS

- A. Crystalline Waterproofing: A prepackaged, proprietary blend of Portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of water to develop crystalline growth within concrete or masonry capillaries to produce an impervious, dense, waterproof concrete or masonry with properties meeting or exceeding the following criteria:

1. Permeability: 0 for water at 33 feet when tested according to CE CRD-C 48.
 2. Compressive Strength: Minimum 3000 psi when tested according to ASTM C 109/C 109M.
- B. Patching Compound: Cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections; with properties meeting or exceeding the following criteria:
1. Compressive Strength: 7600 psi at 28 days when tested according to ASTM C 109/C 109M.
 2. Flexural Strength: 710 psi at 28 days when tested according to ASTM C 348.
 3. Shrinkage: Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.
- C. Plugging Compound: Cementitious compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic); with properties meeting or exceeding the following criteria:
1. Permeability: 30 feet when tested according to CE CRD-C 48.
 2. Compressive Strength: 6000 psi at 28 days when tested according to ASTM C 109/C 109M.
 3. Flexural Strength: 1000 psi at 28 days when tested according to ASTM C 348.
 4. Bond Strength: 300 psi at 14 days when tested according to ASTM C 321.
- D. Water: Potable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Acceptance of Conditions: Examine substrates, with Applicator present, where waterproofing is to be applied.
1. Proceed with application only after unsatisfactory conditions have been corrected.
 2. Notify Architect in writing of active leaks or structural defects that would affect system performance.

3.2 PREPARATION

- A. Protect other work from damage from cleaning, preparation, and application of crystalline waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Stop active water leaks according to waterproofing manufacturer's written instructions.
- C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.
- D. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents to ensure that waterproofing bonds to concrete or masonry surfaces.
1. Clean masonry surfaces according to ASTM D 4261.

- a. Lightweight Concrete Masonry: Etch with 10 percent muriatic (hydrochloric) acid solution or abrade surface by wire brushing. Remove acid residue until pH readings of water after rinse are not more than 1.0 pH lower or 2.0 pH higher than pH of water before rinse.
 - b. Medium- and Normal-Weight Concrete Masonry: Sandblast or bushhammer to a depth of 1/16 inch.
2. Clean concrete surfaces according to ASTM D 4258.
- a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260.
 - b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
3. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application.
1. Dampen surface with water and maintain damp condition until applying waterproofing.
 2. Apply waterproofing to negative-side surfaces.
 3. Number of Coats: Two coats.
 4. Dampen surface between coats.
- B. Final Coat Finish: Smooth
- C. Moist-cure waterproofing for three days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.
- D. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:
1. Onto columns integral with treated walls.
 2. Onto every substrate in areas indicated for treatment, including pipe trenches, pits, and sumps.

3.4 PROTECTION

- A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than three days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 36 deg F.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Engage manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

END OF SECTION

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Insulation under slabs-on-grade.
2. Perimeter foundation wall insulation.
3. Cavity wall insulation.
4. Mineral-wool blanket and board insulation.
5. Vapor retarders.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 072700 - AIR BARRIERS for air and vapor barrier membrane.
2. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roofing insulation.
3. Section 092110 - GYPSUM BOARD ASSEMBLIES for acoustic insulation in gypsum board assemblies.
4. Division 22 - PLUMBING for plumbing insulation.
5. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
 - 3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 FOUNDATION WALL AND UNDER SLAB INSULATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. DiversiFoam Products.
 - 2. Dow Chemical Company.
 - 3. Owens Corning.
- B. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, square edged of type, density, and compressive strength indicated below:
 - 1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
 - 2. For horizontal applications, pedestrian traffic, Type VII, 2.2-lb/cu. ft. minimum density and 60-psi minimum compressive strength.
 - 3. For horizontal applications, vehicular traffic, Type V, 3-lb/cu. ft. minimum density and 100-psi minimum compressive strength.
 - 4. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.2 CAVITY WALL INSULATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. DiversiFoam Products.
 - 2. Dow Chemical Company.
 - 3. Owens Corning.

- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type X, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, and ASTM D 1621 compressive strength of 15 pounds per square inch minimum.
- C. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.3 MINERAL-WOOL BLANKET AND BOARD INSULATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Fibrex Insulation Inc.
 - 2. Owens Corning.
 - 3. Roxul Inc.
 - 4. Thermafiber.
- B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.
- C. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 75 percent.
- D. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.4 SPRAYED-FOAM INSULATION AT GAPS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Canam Building Envelope Specialists; Zerodraft Z1-24 Foam Sealant.
 - 2. Dow Chemical; GreatStuff Pro.
 - 3. Foam-Tech Div. of H.C. Fennell; SuperGreen Foam.
 - 4. Todol Products; Pur Fill 1G.
- B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.
 - 1. Minimum density of 0.4 lb/cu. ft., thermal resistivity of 3.4 deg F x h x sq. ft./Btu x in. at 75 deg F.

2.5 THERMAL AND IGNITION BARRIERS

- A. Thermal Barrier for Foam Plastic Insulation at Occupied Spaces: Provide thermal barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall

have an active building code evaluation report that lists report number and effective dates of product acceptance.

- B. Ignition Barrier for Foam Plastic Insulation at Attic and Crawl Spaces: Provide ignition barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

2.6 VAPOR RETARDERS

- A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated 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. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set rigid insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.
 - 1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.

- B. On horizontal surfaces, loosely lay rigid insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. On units of 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 (if applicable) and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Fill gaps with compatible insulating material.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. 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.
- B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.7 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 vertical joints in vapor retarders over framing by lapping no fewer than two studs.
 - 1. Attach vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
 - 2. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.
- B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.
 - 1. Provide complete digital report with images of test results with recommendations for repairs.
- C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 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

SECTION 072450

DIRECT-APPLIED FINISH SYSTEM (DAFS)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Direct-applied finish system (DAFS) applied over exterior cementitious sheathing.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061600 - SHEATHING; Exterior cementitious sheathing.
 - 2. Section 079200 - JOINT SEALANTS for sealing joints in DAFS with elastomeric joint sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. DAFS Performance: Comply with the following:
 - 1. Bond Integrity: Free from bond failure within DAFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
 - 2. Weathertightness: Resistant to water penetration from exterior into DAFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of DAFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.
- B. Class PB DAFS: Provide DAFS having physical properties and structural performance that comply with the following:
 - 1. Abrasion Resistance: Sample consisting of 1-inch- thick DAFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested per ASTM D 968, Method A.

2. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
3. Accelerated Weathering: Five samples per ICC-ES AC219 showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, delamination, or other characteristics that might affect performance as a wall cladding after testing for 2000 hours when viewed under 5 times magnification per ASTM G 153 or ASTM G 154.
4. Freeze-Thaw: No surface changes, cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination, or indications of delamination between components when viewed under 5 times magnification after 60 cycles per EIMA 101.01.
5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273 and evaluated according to ASTM D 3274.
6. Salt-Spray Resistance: No deleterious affects when tested according to ICC-ES AC219.
7. Tensile Adhesion: No failure in the DAFS, adhesive, base coat, or finish coat when tested per EIMA 101.03.
8. Water Penetration: Sample consisting of 1-inch- thick DAFS mounted on 1/2-inch- thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded-polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
9. Water Resistance: Three samples, each consisting of 1-inch- thick DAFS mounted on 1/2-inch- thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
10. Wind-Driven-Rain Resistance: Resist wind-driven rain according to ICC-ES AC219.
11. Impact Resistance: Sample consisting of 1-inch- thick DAFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following:
 - a. Standard Impact Resistance: 25 to 49 inch-lb.
12. Structural Performance Testing: DAFS assembly and components shall comply with ICC-ES AC219 when tested per ASTM E 330.

1.4 SUBMITTALS

- A. Product Data: For each type and component of DAFS indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For DAFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- D. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
 1. Include similar Samples of exposed accessories involving color selection.
- E. Samples for Verification: 24-inch- square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including a typical control joint filled with sealant of color selected.
 1. Include sealants and exposed accessory Samples to verify color selected.
- F. Qualification Data: For Installer, fabricator/erector, and testing agency.

- G. Material or Product Certificates: For cementitious materials and joint sealant, from manufacturer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for reinforcing mesh, and coating.
- I. Field quality-control reports.
- J. Maintenance Data: For DAFS to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by DAFS manufacturer as qualified to install manufacturer's system using trained workers.
- B. Source Limitations: Obtain DAFS from single source from single DAFS manufacturer and from sources approved by DAFS manufacturer as compatible with system components.
- C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 - 1. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply DAFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit DAFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

- A. Coordinate installation of DAFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, weather-resistant sheathing paper, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and barrier coating of DAFS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dryvit Systems, Inc.
 2. Parex, Inc.; a brand of ParexLahabra, Inc.
 3. Pleko LLC.
 4. Senergy; Degussa Wall Systems, Inc.
 5. SonoWall; Degussa Wall Systems, Inc.
 6. Sto Corp.
- B. Basis of Design: Senergy Stucco 1000; Degussa Wall Systems, Inc.

2.2 MATERIALS

- A. Compatibility: Provide adhesive, fasteners, sheathing, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and with substrates and approved for use by DAFS manufacturer for Project.
- B. Water-Resistive Coatings: DAFS manufacturer's standard formulation and accessories for use as water/weather-resistive barriers, compatible with substrate, and complying with physical and performance criteria of ICC-ES AC212.
- C. Primer/Sealer: DAFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated.
- D. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; DAFS manufacturer's standard or product recommended in writing by DAFS manufacturer.
- E. Drainage Mesh: Provide manufacturer's standard drainage mesh.
- F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other DAFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098 or EIMA 105.01; complying with ASTM D 578 and the following:
1. Standard-Impact Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
 2. Detail Reinforcing Mesh: Not less than 4.0 oz./sq. yd.
 3. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd.
- G. Base-Coat Materials: DAFS manufacturer's standard mixture complying with one of the following:
1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.

4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
- H. Waterproof Adhesive/Base-Coat Materials: DAFS manufacturer's standard waterproof formulation complying with one of the following:
1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
- I. Primer: DAFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- J. Finish-Coat Materials: DAFS manufacturer's standard acrylic-based coating with enhanced mildew resistance, complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 2. Colors: As selected by Designer from manufacturer's full range.
- K. Water: Potable.
- L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with DAFS manufacturer's written instructions; manufactured from zinc.
1. Casing Bead: Prefabricated, one-piece type, of depth required to suit thickness of coating, with face leg perforated for bonding to coating and back leg.
 2. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
- 2.3 MIXING
- A. General: Comply with DAFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by DAFS manufacturer. Mix materials in clean containers. Use materials within time period specified by DAFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of DAFS.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where DAFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Begin coating application only after surfaces are dry.
 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of DAFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect DAFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind DAFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with DAFS manufacturer's written instructions to obtain optimum bond between substrate and coating.

3.3 DAFS INSTALLATION, GENERAL

- A. Comply with ASTM C 1397 and DAFS manufacturer's written instructions for installation of DAFS as applicable to each type of substrate indicated.

3.4 SUBSTRATE PROTECTION APPLICATION

- A. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by DAFS manufacturer for improving adhesion of coating to substrate.
- B. Water-Resistive Coatings: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.
 - 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by DAFS manufacturer's written instructions.
- C. Waterproof Adhesive/Base Coat: Apply over sloped surfaces and where indicated on Drawings to protect substrates from degradation.
- D. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by DAFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with DAFS manufacturer's written instructions and details.

3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of DAFS, at expansion joints, at vent sills, and elsewhere as indicated, according to DAFS manufacturer's written instructions.
 - 1. Expansion Joint: Use where indicated on Drawings.
 - 2. Casing Bead: Use at other locations.

3.6 BASE-COAT INSTALLATION

- A. Base Coat: Apply to exposed surfaces of sheathing in minimum thickness recommended in writing by DAFS manufacturer, but not less than 1/16-inch dry-coat thickness.
- B. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and DAFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh,

applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.

- C. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

- 1. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

3.7 FINISH-COAT INSTALLATION

- A. Primer: Apply over dry base coat according to DAFS manufacturer's written instructions.
- B. Finish Coat: Apply over dry base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by DAFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

- 1. Texture: As selected by Designer from manufacturer's full range.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform tests and inspections and to prepare test reports.
- B. DAFS Tests and Inspections: Comply with testing requirements of authorities having jurisdiction.
 - 1. Notify Contracting Officer and Owner 48 hours in advance of date and time of inspection.
- C. Remove and replace DAFS where test results indicate that DAFS do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from vent, window and door frames and other surfaces outside areas indicated to receive DAFS coatings.

END OF SECTION

SECTION 072700

AIR BARRIERS

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Self-adhering, vapor-retarding, modified bituminous sheet air barrier
 - 2. Flexible flashing and transition strips to adjacent and penetrating materials.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry and cavity wall insulation installed outboard of air and vapor barrier system.
 - 2. Section 061600 - SHEATHING for sheathing substrate for air and vapor barrier system.
 - 3. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for roof air and vapor barrier.

1.3 DEFINITIONS

- A. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall or soffit, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PERFORMANCE REQUIREMENTS

- A. General: 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.

- B. Air Barrier Assembly Air Leakage: Not to exceed 0.03 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., ASTM E 283.

1.5 PRECONSTRUCTION TESTING

- A. 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. The Owner may engage a qualified testing agency.
 - 2. Quantitative Air Leakage Testing: Testing of the mockup for air leakage will be conducted not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage when tested according to ASTM E 283.
 - 3. Notify Architect and the Owner a minimum of seven days in advance of the dates and times when mockup testing will take place.

1.6 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include details of interfaces with other materials that form part of air barrier.
 - 2. Include details of mockups.
- D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory materials with Project materials that connect to or that come in contact with air barrier; signed by product manufacturer.
- E. Qualification Data: For Applicator.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for air barriers.

1.7 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm experienced in applying air barrier materials 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.
- B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly 150 sq. ft., incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.
 - 1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
 - 2. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

3. If the Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1. Include installers of other construction connecting to air barrier, such as roofing, waterproofing, architectural precast concrete, masonry, joint sealants, windows, glazed curtain walls, and door frames.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, mockups, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Store rolls according to manufacturer's written instructions.
- D. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SELF-ADHERING SHEET AIR BARRIER

- A. Sheet-Applied, Vapor-Retarding Modified Bituminous Sheet: 40-mil-thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil-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. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Coatings & Waterproofing; CCW-705.
 - b. Grace, W. R. & Co.; Perm-A-Barrier.
 - c. Henry Company; Blueskin SA.
 - d. Meadows, W. R., Inc.; SealTight Air-Shield.
 - e. Rubber Polymer Corporation; Rub-R-Wall SA.
 - f. Tremco, Inc.; ExoAir 110.
 - g. Or approved equal.
2. Physical and Performance Properties:

- a. Membrane Air Permeance: Not to exceed 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
- b. Tensile Strength: 250 psi minimum; ASTM D 412, Die C, modified.
- c. Ultimate Elongation: 200 percent minimum; ASTM D 412, Die C, modified.
- d. Low-Temperature Flexibility: Pass at minus 20 deg F, ASTM D 1970.
- e. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836.
- f. Puncture Resistance: 40 lbf minimum; ASTM E 154.
- g. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
- h. Vapor Permeance: 0.05 perms, ASTM E 96, Water Method.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne or solvent-borne primer recommended for substrate by manufacturer of air barrier material.
- C. Flexible Flashing and Flexible Thru-wall Flashing: Modified bituminous 40-mil-thick, self-adhering sheet consisting of 32 mils of rubberized asphalt laminated to an 8-mil-thick, crosslaminated polyethylene film with release liner backing.
- D. Butyl Strip at Termination with EPDM or TPO Roofing Membrane: Vapor-retarding, 30- to 40-mil-thick, self adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
- E. Modified Bituminous Strip To Cover Cracks and Joints and Terminate Air Barrier to Compatible Roofing Membrane: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil- polyethylene film with release liner backing.
- F. Termination Mastic: Cold fluid-applied elastomeric liquid; trowel grade.
- G. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- H. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- I. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- J. Sprayed Polyurethane Foam Sealant to Fill Gaps at Penetrations and Openings: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft. density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
- K. Modified Bituminous Transition Strip to Seal Air Barrier Terminations with Glazing Systems: Vapor-retarding, 40-mil-thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.
- L. Preformed Silicone-Sealant Extrusion to Seal Air Barrier Terminations with Glazing Systems: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation, 123 Silicone Seal.
 - b. GE Silicone, UltraSpan US1100.
 - c. Pecora Corporation, Sil-Span.
 - d. Tremco, Incorporated, Spectrem EZ Simple Seal.
 - e. Or approved equal.

- M. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Section 079200 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
 5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
 1. Install modified bituminous strips and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch.
- G. Bridge and cover isolation joints expansion joints and discontinuous deck-to-wall and deck-to-deck joints with overlapping modified bituminous strips.

- H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

3.3 TRANSITION STRIP INSTALLATION

- A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.
- B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- C. 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.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- E. 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.
- F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply [modified bituminous transition strip] [adhesive-coated transition strip] [elastomeric flashing sheet] [preformed silicone-sealant extrusion] so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
 - 2. 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.
 - 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.
- G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

- I. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, modified bituminous strip.
- J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 INSTALLATION OF SELF-ADHERING SHEET MEMBRANE

- A. Install modified bituminous sheets 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, install self-adhering, modified bituminous air barrier sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- B. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
 - 1. Install modified bituminous strips centered over vertical inside corners. Install 3/4-inch fillets of termination mastic on horizontal inside corners.
- C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.
 - 1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.
- E. Apply and firmly adhere modified bituminous sheets horizontally or vertically over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch-minimum lap widths and 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.
 - 3. Apply termination mastic on any horizontal, field-cut or non-factory edges.
- F. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.
- G. Seal top of non-metallic through-wall flashings to air barrier sheet with an additional 6-inch-wide strip.
- H. Seal exposed edges of metallic sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- I. Install air barrier sheets and auxiliary materials to form a seal with adjacent construction and to maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 2. Install compatible strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over both substrates.
- J. 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.
- K. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply membrane specified below so that a minimum of 3 inches of coverage is achieved over both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not less than 1 inch of full contact.
1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
 2. 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.
 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls, frame, and membrane.
- L. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, and miscellaneous penetrations of air barrier membrane with foam sealant.
- M. At end or each working day, seal top edge of membrane to substrate with termination mastic.
- N. 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.
- O. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches beyond repaired areas in all directions.
- P. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- Q. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.
- 3.5 FIELD QUALITY CONTROL
- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may 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. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 4. Site conditions for application temperature and dryness of substrates have been maintained.

5. Maximum exposure time of materials to UV deterioration has not been exceeded.
6. Surfaces have been primed.
7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
8. Termination mastic has been applied on cut edges.
9. Air barrier has been firmly adhered to substrate.
10. Compatible materials have been used.
11. Transitions at changes in direction and structural support at gaps have been provided.
12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation, and priming of surfaces, structural support, integrity, and continuity of seal.
13. All penetrations have been sealed.

C. Tests:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186.
2. Quantitative Air Leakage Testing: Testing not to exceed the test pressure differential, positive and negative, indicated in "Performance Requirements" Article for air barrier assembly air leakage according to ASTM E 283.

D. Remove and replace deficient air barrier components and retest as specified above.

3.6 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. Remove and replace air barrier exposed to these conditions for more than 30 days.
 2. Protect air barrier from contact with creosote, uncured coal-tar products, TPO, EPDM, flexible PVC membranes, and sealants not approved by air barrier manufacturer.
- B. Clean spills, stains, and soiling from adjacent construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 074200
METAL WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal-faced composite wall panels and attachment systems.
 - 2. Factory-formed and -assembled, non-insulated metal wall panels.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 054000 - COLD-FORMED METAL FRAMING for secondary support framing supporting metal wall panels.
 - 2. Section 072100 - THERMAL INSULATION for insulation behind metal wall panels.
 - 3. Section 076200 - SHEET METAL FLASHING AND TRIM for copings, flashings, and other sheet metal work not part of metal wall panel assemblies.
 - 4. Section 079200 - JOINT SEALANTS for field-applied sealants not otherwise specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide metal wall panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.
- B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- C. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 and ASTM E 330 as applicable.
 - 1. Wind Loads: As required by Code.

2. Deflection Limits: Engineer metal wall panel assemblies to withstand test pressures with deflection no greater than 1/180 of the span and no evidence of material failure, structural distress, or permanent deformation exceeding 0.2 percent of the clear span, at code required loading.
- D. Thermal Movements for Metal-Faced Composite Wall Panels: Provide composite wall panel assemblies that allow for noiseless thermal movements resulting from the following range in ambient temperatures and that prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects:
 1. Ambient Temperature Range: Minus 20 to plus 180 deg F.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories. Include 4-way joint for composite panels.
 2. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- F. Qualifications: Qualifications of professional engineer and qualifications of installer as specified.

1.5 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of panels that are similar to those indicated for this Project in material, design, and extent.
- B. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 1. Installer's responsibilities include fabricating and installing metal wall panel assemblies and providing professional engineering services needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

- C. Fabricator Qualifications: Certified by metal-faced composite wall panel manufacturer to fabricate and install manufacturer's wall panel system.
 - D. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.
 - E. 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 manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - 1. Meet with The Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 - 7. Review temporary protection requirements for metal wall panel assembly during and after installation.
 - 8. Review wall panel observation and repair procedures after metal wall panel installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
 - G. Mockups: Provide mock-ups as specified in Section 014330, Mock-Ups, coordinate with other trades as required.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.
 - B. Unload, store, and erect metal wall panels in a manner to prevent bending, warping, twisting, and surface damage.
 - C. Stack metal wall panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage.

- D. Store metal-faced composite wall panels vertically, covered with suitable weathertight and ventilated covering. Store metal-faced composite wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal-faced composite wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.
- E. Protect strippable protective covering on metal wall panels from exposure to sunlight and high humidity, except to extent necessary for period of metal wall panel installation.

1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal wall panels without field measurements, or allow for field trimming of panels. Coordinate wall construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of girts, studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including rupturing, cracking, or puncturing.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels 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 D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL-FACED COMPOSITE WALL PANELS (MP-4)

- A. General: Provide factory-formed and -assembled metal-faced composite wall panels fabricated from two metal facings bonded, using no glues or adhesives, to solid extruded thermoplastic core; formed into profile for installation method indicated. Include attachment system components and accessories required for weathertight system.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. 3A Composites USA, Inc.; Alucobond.
 2. Alcoa Inc.; Reynobond.
 3. CENTRIA Architectural Systems; Formabond Wall System.
 4. Firestone Metal Products, LLC; UNA-FAB Series 1000.
 5. Protean Construction Products, Inc.; ACM 100.
- C. Aluminum-Faced Composite Wall Panels Smooth surface, formed with 0.020-inch- thick, coil-coated aluminum sheet facings, panel thickness 0.157 inch (4 mm).
- D. Fluoropolymer Three-Coat Finish System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil ; complying with AAMA 2605.
- E. Attachment System Components: Formed from extruded aluminum. Include manufacturer's standard perimeter extrusions, panel stiffeners, panel clips and anchor channels.
- F. Trim: Same material, finish, and color as facings of adjacent composite panels, unless otherwise indicated.
- G. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.
 1. Fasteners for Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2.2 CORRUGATED METAL WALL PANELS

- A. Basis-of Design Products: Provide the following products as manufactured by Centria or approved equal products by Kingspan or Firestone.
 1. MP1: Centria, Concept Series - #CS-660, with concealed fasteners.
 2. MP2: Centria, IW Series - #IW-40A, with concealed fasteners.
 3. MP3: Centria, IW Series - #IW-10A, with concealed fasteners.

- B. Fluoropolymer Three-Coat Finish System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil ; complying with AAMA 2605.
 - 1. Color: As selected by Architect from manufacturer's full range.
- C. Attachment System Components: Formed from extruded aluminum. Include manufacturer's standard perimeter extrusions, panel stiffeners, panel clips and anchor channels.
- D. Trim: Same material, finish, and color as facings of adjacent composite panels, unless otherwise indicated.
- E. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal wall panels by means of plastic caps or factory-applied coating.
 - 1. Fasteners for Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2.3 ACCESSORIES

- A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels, unless otherwise indicated.
- B. Trim: Formed from 0.0179-inch-thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.4 METAL FRAMING

- A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60 , hot-dip galvanized zinc coating.
- B. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare metal thickness of 0.0179 inch and depth required to fit insulation thickness indicated.
- C. Rainscreen System: Provide system that has been tested in accordance with AAMA 508-05 (Pressure Equalized Rain Screen Wall Cladding Test) – Standard Test Method for Water Penetration of Exterior Vented Rainscreen Panel System. The test requires a minimum airflow of 1 CFM / SF of weather wall area through the vented rainscreen system to replicate severe storm and imperfection in air/vapor barrier system. While maintaining 1 CFM/SF airflow, the system must be able to pressure equalize and sustain zero pressure difference between the interior and exterior wall cavity without any water penetration.

1. Manufacturers: Universe Systems, Division of Universe Corporation; LYMO Architectural Panel Systems Inc.; POHL Inc. of America; Centria Architectural Systems; Metal Sales & Service, Inc.; or approved equal.
 2. Rout and return wall panel system with dry joints for rainscreen assembly; as approved by the Architect.
- D. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.5 FABRICATION

- A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
1. Form panel lines, breaks, and angles to be sharp and true, with surfaces free from warp and buckle.
 2. Fabricate wall panels with panel stiffeners as required to maintain fabrication tolerances and to withstand design loads.
- B. Metal-Faced Composite Wall Panels: Factory form panels. Trim and square edges of sheets with no displacement of face sheets or protrusion of core material.
1. Fabricate panels with panel stiffeners, as required to comply with deflection limits, attached to back of panels with structural silicone sealant or bond tape.
 2. Fabricate panels with sharply cut edges, with no displacement of face sheets or protrusion of core material.
 3. Dimensional Tolerances:
 - a. Length: Plus 0.375 inch.
 - b. Width: Plus 0.188 inch.
 - c. Thickness: Plus or minus 0.008 inch.
 - d. Panel Bow: 0.8 percent maximum of panel length or width.
 - e. Squareness: 0.2 inch maximum.
- C. Sheet Metal Accessories: Fabricate trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 4. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.

- a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal wall panel supports, and other conditions affecting performance of work.
 - 1. Examine primary and secondary wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine solid wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - 3. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
- B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of metal wall panels before metal wall panel installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.
- B. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal wall panel manufacturer's written recommendations.

3.3 METAL WALL PANEL INSTALLATION, GENERAL

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal wall

panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal wall panels by torch is not permitted.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Pre-drill panels.
4. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until weather barrier and flashings that will be concealed by metal wall panels are installed.
5. Install screw fasteners in pre-drilled holes.
6. Locate and space fastenings in uniform vertical and horizontal alignment.
7. Install flashing and trim as metal wall panel work proceeds.
8. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Fasteners, Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal wall panel manufacturer.

3.4 WALL PANEL INSTALLATION

A. General: Install attachment system required to support wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.

1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
2. Do not begin installation until weather barrier and flashings that will be concealed by composite panels are installed.

B. Track-Support Installation: Provide manufacturer's standard horizontal and vertical tracks that provide support and complete secondary drainage system, draining to the exterior at horizontal joints. Install support system at locations, spacings, and with fasteners recommended by manufacturer. Attach panels to wall by interlocking tracks with perimeter extrusions attached to wall panels. Fully engage integral gaskets and leave horizontal and vertical joints with open reveal.

1. Attach routed-and-returned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.

3.5 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
- B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
 1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal wall panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal wall panel installation, clean finished surfaces as recommended by metal wall panel manufacturer. Maintain in a clean condition during construction.
- B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 075400

THERMOPLASTIC MEMBRANE ROOFING

(Part of Work of Section 070002 - ROOFING AND FLASHING, Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Heat welded, mechanically fastened membrane-roofing system.
2. Cover board.
3. Roof insulation.
4. Vapor retarder.
5. PVC clad metal roof edge.
6. Roof expansion joint covers.
7. Flashing for equipment mounted on roofing and roofing penetrations.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
2. Section 076200 - SHEET METAL FLASHING AND TRIM for metal roof penetration flashings, flashings, and counterflashings.
3. Section 079200 - JOINT SEALANTS for sealants.
4. Division 22 - PLUMBING for roof drains.
5. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof curbs for HVAC equipment.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience. Roofing System Design: Roofing system shall be designed to withstand Code required loads and wind speeds., but no less than 72 mph.
- D. Flashings: Provide base flashings, perimeter flashings, detail flashings and component materials that comply with requirements and recommendations in FMG 1-49 Loss Prevention Data Sheet for Perimeter Flashings; FMG 1-29 Loss Prevention Data Sheet for Above Deck Roof Components; NRCA Roofing and Waterproofing Manual (Fourth Edition) for Construction Details and SMACNA Architectural Sheet Metal Manual (Fifth Edition) for Construction Details, as applicable.
- E. Fire Performance: Provide roofing system with UL Class A [and FM 1-90].
- F. Energy Performance: Provide roofing system with Solar Reflectance Index (SRI) not less than 78 when calculated according to ASTM E 1980 based on testing identical products by a qualified testing agency.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns.
- C. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- D. Qualification Data: For Installer and manufacturer.
- E. Maintenance Data: For roofing system to include in maintenance manuals.
- F. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.
- G. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain components for roofing system from or approved by roofing system manufacturer.
- B. Roofing Inspector: Owner may engage a full-time roofing inspector during installation of the deck, insulation assembly, membrane, flashing and other appurtenances, and when a survey of

the roof and roof drains is conducted. Cooperate with Owner's roofing inspector and allow unlimited access to roofing during construction.

- C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01. Review methods and procedures related to roofing system including, but not limited to, the following:
1. Meet with the Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 5. Review structural loading limitations of roof deck during and after roofing.
 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 7. Review governing regulations and requirements for insurance and certificates if applicable.
 8. Review temporary protection requirements for roofing system during and after installation.
 9. Review roof observation and repair procedures after roofing installation.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

- A. Roofing Contractor's Warranty: The roofing subcontractor shall supply Owner with a minimum two-year workmanship warranty for each roof. In the event any work related to the roofing, flashing, or metalwork is found to be defective within two years of substantial completion, the roofing contractor shall remove and replace such at no additional cost to the Owner. The roofing subcontractor's warranty obligation shall run directly to the Owner, and a copy the roofing signed warranty shall be sent to the roofing system's manufacturer.
1. The duration of the Roofing Contractor's two-year warranty shall run concurrent with the roofing system's manufacturer's 20-year warranty.
- B. Roofing Systems Manufacturer's Warranty: The roofing manufacturer shall guarantee roof areas to be in a watertight condition, for a period of 20 years, from the date of final acceptance of the roofing system. The warranty shall be a 20-year no dollar limit (NDL), non-prorated total system labor and material warranty, for wind speeds up to 72 miles per hour. Total system warranty shall include all roofing materials, related components and accessories including, but not limited to the substrate board, vapor retarder, insulation board, cover board, roofing membrane, membrane flashings, fasteners, adhesives, metal roof copings, metal roof edges and termination metals and roof drain assemblies. The manufacturer shall repair defects in materials and workmanship as promptly after observation as weather and site conditions permit.

PART 2 - PRODUCTS

2.1 PVC ROOFING MEMBRANE

- A. PVC Sheet: ASTM D 4434, Type III, fabric reinforced.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle SynTec Incorporated.
 - b. Johns Manville International, Inc.
 - c. Duro-Last Roofing, Inc.
 - d. Flex Roofing Systems.
 - e. Sarnafil Inc.
 2. Thickness: 60 mils (1.5 mm), nominal.
 3. Exposed Face Color: Roof membrane to be white and dark grey as indicated.
 4. Basis of Design: Sika Sarnafil Rhinobond, or approved equal.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
1. Liquid - type auxiliary materials shall meet the lowest VOC limit available that is recommended by the manufacturer for the intended use and is compatible with the membrane roofing.
- B. PVC-Clad Metal Roof Edge: Heat-weldable flashing designed to serve as gravel stop and fascia at perimeter of thermoplastic membrane roofing.

1. Composition: 25 gauge steel with G90 galvanized coating, with 20 mil (1 mm) PVC membrane laminated to the outside face. Provide unsupported width of membrane along edge to be welded to roofing membrane.
 2. Profile: As shown on Drawings.
 3. Product: Sarnafil, Inc., Sarnaclad, or equal product approved by manufacturer of roofing system.
 4. Exposed Face Color: White and Dark Gray at indicated locations.
- C. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane.
- D. Bonding Adhesive: Manufacturer's standard bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings.
- E. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- F. Fasteners: 3 inch (75 mm) round, 22 gauge corrosion resistant steel plate with a polymer coating used with various manufacturer standard fasteners to attach insulation boards to the roof deck and as a substrate to induction weld the roofing membrane.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.
- H. Roofing Expansion Joints: Provide roofing manufacturer's standard roofing expansion joint covers in accordance with details and configurations as indicated on drawings.

2.3 VAPOR RETARDER

- A. Loose-Laid Sheet Vapor Retarder: Minimum 10 mil polyethylene sheet with maximum permeance rating of 0.1 perm.
1. Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.4 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated.
- B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas Roofing Corporation.
 - b. Carlisle SynTec Incorporated.
 - c. Firestone Building Products Company.
 - d. GAF Materials Corp.
 - e. GenFlex Roofing Systems.
 - f. Johns Manville International Inc.

- C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of + 1/8 inch per 12 inches unless otherwise indicated.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

- A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch thick. Provide USG – Securock with primer, or approved equal.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, solid-rubber, slip-resisting, surface-textured walkway pads or rolls approximately 3/16 inch thick, and acceptable to membrane roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Section 053100 - STEEL DECKING.
 - 4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
 - 5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 - 6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
 - 7. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 VAPOR-RETARDER INSTALLATION

- A. Polyethylene Film Vapor Retarder: Loosely lay polyethylene-film vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 2 inches and 6 inches, respectively. Continuously seal side and end laps with tape.
- B. Completely seal vapor retarder at side laps, end laps, terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.4 INSULATION AND COVERBOARD INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.
- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation under area of roofing to conform to slopes indicated.
- D. Install one or more layers of insulation under area of roofing to achieve required thickness. Install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
 - 1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
- G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
 - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
 - 3. For insulation applied in multiple layers, loose-lay first layer and mechanically fasten top layer.

3.5 ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over area to receive roofing according to membrane roofing system manufacturer's written instructions. Unroll roofing membrane and allow to relax before installing.
 - 1. For PVC membrane, install sheet according to ASTM D 5036.

- B. Start installation of roofing membrane in presence of membrane roofing system manufacturer's technical personnel.
- C. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing using induction heat welding technology.
- E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply solvent-based bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive 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 (except for heat-welded application), 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.

3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports. Manufacturer's Technical Representative: Engage a qualified manufacturer's technical representative to perform roof tests and inspections and to prepare test reports.

- B. Leak Tests: Prior final acceptance of the roof system and prior to the installation of interior ceilings and finishes, prove that the roof does not leak due to intentionally ponded water.
 - 1. Test Procedure: Perform test only when rain is not predicted during the test period. Block roof drains. Pond 2 inches of water over high points of roof. Maintain ponding for 24 hours.
 - 2. Leaks: Observe building interior for leaks. Identify, record, and report all leak locations
 - 3. Leak Remediation: Remove and replace all roof materials under roof membrane wetted by leak. Pay for removal and replacement of all interior insulation and materials wetted by leak. Repair leaks. Repeat testing and repairs until leak free roof assembly is achieved and proven
 - 4. Contractor's Option: Electric Field Vector Mapping leak detection instead of flood test.
- C. Final Roof Inspection: Engage roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect and the Owner 48 hours in advance of date and time of inspection.
- D. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage during installation. The General Contractor shall protect the completed installed roof from traffic, dropped items solvents and other roof damage. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage describing its nature and extent in a written report, with copies the Architect and Owner.
- B. Correct deficiencies in or remove membrane-roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane-roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 076200

SHEET METAL FLASHING AND TRIM

(Part of Work of Section 070002 - ROOFING AND FLASHING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Sheet metal flashing and trim for the following applications:
 - a. Through-wall flashing.
 - b. Formed wall flashing and trim.
 - c. Formed low-slope roof flashing and trim.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 042000 - UNIT MASONRY for through-wall flashings in masonry.
2. Section 061000 - ROUGH CARPENTRY for wood nailers, curbs, and blocking.
3. Section 072700 - AIR BARRIERS for perimeter terminations at air and vapor barrier assembly.
4. Section 074200 - METAL WALL PANELS for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
5. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane.
6. Section 079200 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

- B. Fabricate and install roof edge flashing and copings capable of resisting Wind Zone forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49.

- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.
 - 2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim: 12 inches long. Include fasteners and other exposed accessories.
 - 3. Accessories: Full-size Sample.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- B. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Meet with the Owner, Architect and Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
 - 2. Review methods and procedures related to sheet metal flashing and trim.
 - 3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.

4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

- A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005. Thickness as specified in this Section. Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
 1. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - a. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil; complying with AAMA 2605.
 - 1) Color: As selected by Architect from manufacturer's full range.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, with No. 2D dull, cold rolled finish. Thickness as specified in this Section.

2.2 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
- B. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

2.3 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - 2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
- C. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- G. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. 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.
- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

- E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Furnish with 6-inch-wide joint cover plates.
 - 1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 - 2. Fabricate from the following material:
 - a. Copper: 20 oz./sq. ft. (0.68 mm thick).
 - b. Aluminum: 0.050 inch (1.27 mm) thick.
 - c. Stainless Steel: 0.019 inch (0.48 mm) thick.
 - d. Zinc: 0.059 inch (1.50 mm) thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Joint Style: Butt, with 12-inch-wide concealed backup plate.
 - 2. Fabricate copings from the following material:
 - a. Copper: 24 oz./sq. ft. (0.82 mm thick).
 - b. Aluminum: 0.050 inch (1.27 mm) thick.
 - c. Stainless Steel: 0.025 inch (0.64 mm) thick.
 - d. Zinc: 0.059 inch (1.50 mm) thick.
- C. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from the following material:
 - 1. Copper: 16 oz./sq. ft. (0.55 mm thick).
 - 2. Aluminum: 0.050 inch (1.27 mm) thick.
 - 3. Stainless Steel: 0.025 inch (0.64 mm) thick.
 - 4. Zinc: 0.039 inch (1.00 mm) thick.
- D. Base Flashing: Fabricate from the following material:
 - 1. Copper: 20 oz./sq. ft. (0.68 mm thick)
 - 2. Aluminum: 0.040 inch (1.02 mm) thick.
 - 3. Stainless Steel: 0.019 inch (0.48 mm) thick.

4. Zinc: 0.039 inch (1.00 mm) thick.

E. Counterflashing: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum: 0.032 inch (0.81 mm) thick.
3. Stainless Steel: 0.019 inch (0.48 mm) thick.
4. Zinc: 0.039 inch (1.00 mm) thick.

F. Roof-Penetration Flashing: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Stainless Steel: [0.019 inch (0.48 mm) thick.
3. Zinc: 0.039 inch (1.00 mm) thick.

G. Roof-Drain Flashing: Fabricate from the following material:

1. Copper: 12 oz./sq. ft. (0.41 mm thick).
2. Stainless Steel: 0.016 inch (0.40 mm) thick.

H. Splash Pans: Fabricate from the following material:

1. Stainless Steel: 0.0187 inch thick.

2.6 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing, Typical: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch-high end dams. Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Stainless Steel: 0.016 inch (0.40 mm) thick.
3. Zinc: 0.039 inch (1.00 mm) thick.

B. Through-Wall Flashing, In Masonry: Through-wall flashing in masonry is specified in Section 042000 – UNIT MASONRY.

C. Wall Expansion-Joint Cover: Fabricate from the following material:

1. Copper: 16 oz./sq. ft. (0.55 mm thick).
2. Aluminum: 0.040 inch (1.02 mm) thick.
3. Stainless Steel: 0.019 inch (0.48 mm) thick.
4. Zinc: 0.039 inch (1.00 mm) thick.

2.7 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.
 - 1. Coat side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip-sheet or install a course of polyethylene underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. 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.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
 2. Aluminum: Use aluminum or stainless steel fasteners.
 3. Stainless Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.
 1. Where sealant-filled joints are used, 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 moderate, between 40 and 70 deg F set joint members for 50 percent movement either 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.
- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
 1. Do not solder aluminum sheet.
 2. Stainless-Steel Soldering: Prein edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
 3. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.
- J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements[, sheet metal manufacturer's written installation instructions,] and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless steel draw band and tighten.
- C. 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 a minimum of 4 inches and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of snap-in installation and sealant.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing In Masonry: Installation of through-wall flashing in masonry is specified in Section 042000 - UNIT MASONRY.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. 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

SECTION 077200

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. Roof hatches and safety rails.
- 2. Elevator vents.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

- 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 055000 - METAL FABRICATIONS for metal vertical ladders, ships' ladders, and stairs for access to roof hatches, and from roof to roof.
- 2. Section 061000 - ROUGH CARPENTRY for wood cants and wood nailers
- 3. Section 076200 - SHEET METAL FLASHING AND TRIM for shop- and field-fabricated metal flashing and counterflashing, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
- 4. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for roof-mounted ventilators.
- 5. Division 26 - ELECTRICAL for power supply and final connections for automatically operated heat and smoke vents.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

- C. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 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.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

- A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.

1. Available Manufacturers:

- a. Babcock-Davis; a Cierra Products Inc. Company.
- b. Bilco Company (The).
- c. Nystrom, Inc.
- d. O'Keeffe's Inc.
- e. Wasco Products, Inc.

- 2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.

- 3. Type and Size: Lid type and size as indicated on Drawings.

- 4. Curb and Lid Material: Galvanized steel sheet, 0.079 inch thick.

- 5. Insulation: Manufacturer's standard board insulation.

- 6. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.

- 7. Exterior Curb Liner: Manufacturer's standard metal liner of same material and finish as metal curb.

- 8. Fabricate units to minimum height of 12 inches unless otherwise indicated.

- 9. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

- 10. Ladder Safety Post: Manufacturer's standard ladder safety post. Post to lock in place on full extension. Provide release mechanism to return post to closed position.

- B. 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. Chain Passway Barrier: Galvanized proof coil chain with quick link on fixed end.
 6. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
 7. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
 8. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
 9. Fabricate joints exposed to weather to be watertight.
 10. Fasteners: Manufacturer's standard, finished to match railing system.
 11. Finish: Manufacturer's standard.

2.2 ELEVATOR VENT

- A. Elevator Hoistway Penthouse Vent: Provide louvered penthouse assemblies with automatic dampers, complying with the following:
1. Available Manufacturers:
 - a. Aiolite Corp.
 - b. Industrial Louvers Inc.
 - c. McDermott Metal Works Corp.
 - d. Or approved equal.
 2. Basis of Design Model Number: Industrial Louvers Inc. 480XP Penthouse Louver, or approved equal.
 3. Finish: Manufacturer's standard mill finish.

2.3 MISCELLANEOUS MATERIALS

- A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWWA C2; not less than 1-1/2 inches thick.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by roof accessory manufacturer. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.
- D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, or PVC; or flat design of foam rubber, sponge neoprene, or cork.
- E. Elastomeric Sealant: ASTM C 920, polyurethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 - 2. Verify dimensions of roof openings for roof accessories.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.
- C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing exposed-to-view components of 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 underlayment.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by roof accessory manufacturers for waterproof performance.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Hatch Installation:
 - 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
 - 2. Attach safety railing system to roof hatch curb.
 - 3. Attach ladder safety post according to manufacturer's written instructions.
- F. Elevator Vent Installation: Locate, install, and test heat and smoke vents according to NFPA 204.
 - 1. Check vent for proper operation. Adjust operating mechanism as required.
- G. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.3 TOUCH UP

- A. Touch up factory-primed surfaces with compatible primer ready for field painting in accordance with Section 099000 - PAINTING AND COATING.

- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.4 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION

SECTION 078100

APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Concealed sprayed fire-resistive materials.
 - 2. Exposed sprayed fire-resistive materials.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete protecting structural steel.
 - 2. Section 042000 - UNIT MASONRY for masonry protecting structural steel.
 - 3. Section 051200 - STRUCTURAL STEEL FRAMING for surface conditions required for structural steel receiving sprayed fire-resistive materials.
 - 4. Section 072100 - THERMAL INSULATION for fire-safing insulation.
 - 5. Section 078410 - PENETRATION FIRESTOPPING for firestopping and firesafing insulation.
 - 6. Section 092110 - GYPSUM BOARD ASSEMBLIES for fire-resistance-rated assemblies.
 - 7. Section 092120 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES for fire-resistance-rated assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Structural framing plans indicating the following:
 - 1. Locations and types of surface preparations required before applying sprayed fire-resistive material.

2. Extent of sprayed fire-resistive material for each construction and fire-resistance rating, including the following:
 - a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
 3. Treatment of sprayed fire-resistive material after application.
- D. Samples for Verification: For each type of colored, exposed sprayed fire-resistive material, two Samples, each 4 inches square, of each color, texture, and material formulation to be applied. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- E. Qualification Data: For Installer, manufacturer, and testing agency.
- F. Compatibility and Adhesion Test Reports: From sprayed fire-resistive material manufacturer indicating the following:
1. Materials have been tested for bond with substrates.
 2. Materials have been verified by sprayed fire-resistive material manufacturer to be compatible with substrate primers and coatings.
 3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed sprayed fire-resistive materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its sprayed fire-resistive materials to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. Testing Agency Qualifications: An independent approved testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented in accordance with local State Building Code.
- C. Source Limitations: Obtain sprayed fire-resistive materials through one source from a single manufacturer.
- D. Sprayed Fire-Resistive Materials Testing: By an approved testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
1. Sprayed fire-resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Testing is performed on specimens of sprayed fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.

3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.
- E. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
 1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with sprayed fire-resistive material.
 - F. Fire-Test-Response Characteristics: Provide sprayed fire-resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing sprayed fire-resistive materials with appropriate markings of applicable testing and inspecting agency.
 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for sprayed fire-resistive material serving as direct-applied protection tested per ASTM E 119.
 2. Surface-Burning Characteristics: ASTM E 84, limits in accordance with local State Building Code.
 - G. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
 - H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to sprayed fire-resistive materials including, but not limited to, the following:
 1. Review and finalize construction schedule and verify sequencing and coordination requirements.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
 - B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
 - C. Store materials inside, under cover, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.
- 1.6 PROJECT CONDITIONS
- A. Environmental Limitations: Do not apply sprayed fire-resistive material when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat is 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 sprayed fire-resistive material. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly. Comply with manufacturer's recommended ventilation procedures.

1.7 COORDINATION

- A. Sequence and coordinate application of sprayed fire-resistive materials 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. Except for thin-film intumescent fireproofing, do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
 - 8. 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.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace sprayed fire-resistive materials that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of sprayed fire-resistive materials from substrates.
 - 2. Not covered under the warranty are failures due to damage by occupants and the Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
- B. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For concealed applications of sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and physical properties representative of installed products.

- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Cementitious Sprayed Fire-Resistive Material:
 - a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Pyrolite 15.
 - b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 5GP.
 - c. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type MK-6/HY.
 - d. Isolatek International, Cafco Products; Cafco 300.
 - e. Southwest Fireproofing Products Co., Inc.; 5EF.
- C. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- D. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
1. Dry Density: 15 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWC Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.
 - b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft..
 3. Bond Strength: 150 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E 736.
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

4. Compressive Strength: 5.21 lbf/sq. in. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.2 SEMI-EXPOSED CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS **Use this for Hi Rise Construction, not concealed type.**

- A. General: For exposed applications with high potential for physical damage or exposure to moisture or high humidity for sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Semi-Exposed Cementitious Sprayed Fire-Resistive Material:
 - a. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; Pyrocrete 239.
 - b. Carboline Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7GP or 5MD.
 - c. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type Z106.
 - d. Isolatek International Corp., Cafco Products.; Cafco 400.
 - e. Pyrok, Inc.; Pyrok-MD.
- C. Material Composition: Cementitious sprayed fire-resistive material consisting of factory-mixed, dry formulation of gypsum or portland cement binders and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application, per ASTM E 1513.
- D. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
 1. Dry Density: 22 lb/cu. ft. for average and individual densities regardless of density indicated in referenced fire-resistance design, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWC Technical Manual 12-A, Section 5.4.5, "Displacement Method."
 2. Thickness: Provide minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
 - a. Where the referenced fire-resistance design lists a thickness of 1 inch or greater, the minimum allowable individual thickness of sprayed fire-resistive material is the design thickness minus 0.25 inch.

- b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of sprayed fire-resistive material is the greater of 0.375 inch or 75 percent of the design thickness.
 - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft..
3. Bond Strength: 430 lbf/sq. ft. minimum per ASTM E 736 under the following conditions:
- a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E 736.
 - c. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.
4. Compressive Strength: 400 lbf/sq. ft. as determined in the laboratory per ASTM E 761. Minimum thickness of sprayed fire-resistive material tested shall be 0.75 inch and minimum dry density shall be as specified, but not less than 15 lb/cu. ft.
5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
8. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of sprayed fire-resistive material is 0.75 inch maximum dry density is 15 lb/cu. ft. test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
9. Fungal Resistance: No observed growth on specimens per ASTM G 21.

2.3 EXPOSED CEMENTITIOUS SPRAYED FIRE-RESISTIVE MATERIALS

- A. General: For exposed applications subject to physical abuse or exposure to moisture or high humidity for sprayed fire-resistive materials, provide manufacturer's standard products complying with requirements indicated for material composition and for minimum physical properties of each product listed, measured by standard test methods referenced with each property.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Exposed Cementitious Sprayed Fire-Resistive Material:
 - a. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; Pyrocrete 40.
 - b. Carbolite Company, subsidiary of RPM International, Fireproofing Products Div.; AD Southwest Fireproofing Type 7HD.
 - c. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type Z146.
 - d. Isolatek International Corp., Cafco Products.; Fendolite MII.
 - e. Pyrok, Inc.; Pyrok-HD.
 - f. Southwest Fireproofing Products Co.; 7HD.

2.4 EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

A. Exposed Intumescent Mastic Fire-Resistive Materials:

1. Conditioned Interior Space Conditions: Coatings limited to interior climate controlled spaces having no exposure to condensation, and where the relative humidity and temperature are controlled according to the manufacturers recommendations or to not more than 75 percent, which ever is less, during the application and curing of the coating, the construction and the occupancy of the building.
 - a. Carboline Co., subsidiary of PRM International, Fireproofing Products Div.; Nullifire S607 and Nullifire S606 without topcoat.
 - b. NuChem Inc.: Thermo-Sorb without topcoat.
2. Interior General Use Conditions: Coatings limited to interior service where protection of the coating during application and curing, the construction and the occupancy of the building are as recommended by the product manufacturer for the specific application.
 - a. A/D Fire Protection Systems Inc.; Firefilm III and Colorcoat.
 - b. Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.
 - c. Carboline Company, a subsidiary of RPM International, Fireproofing Products Div.; Nullifire S607 or Nullifire S606 and Topseal.
 - d. Isolatek International Corp., Cafco Products; Cafco SprayFilm-WB 2 or WB-3 Basecoat and Topseal.
 - e. NuChem Inc.; Thermo-Sorb with topcoat.
3. Exterior Use Conditions: Coatings for exterior use or interior use where exterior environmental conditions exist.
 - a. Albi Manufacturing, Division of StanChem Inc.; Albi Clad 800.
 - b. Carboline Co, a subsidiary of RPM International, Fireproofing Products Div.; Nullifire S607 and Topseal.
 - c. Isolatek International Corp., Cafco Products; Cafco SprayFilm-WB 4 with Topseal.
 - d. International Paint, LLC; Interchar 212 with topcoat.
 - e. NuChem Inc.; Thermo-Lag 3000 with topcoat.

B. Thin-Film Fire-Resistive Intumescent Mastic Coating: Factory-mixed formulation.

1. Approved by manufacturer and authorities having jurisdiction for interior or exterior use.
2. Multicomponent system consisting of primer, intumescent base coat and topcoat.
3. Systems shall comply with applicable VOC requirements and meet OTC emission regulations.

C. Color and Gloss: As indicated by manufacturer's designations.

2.5 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with sprayed fire-resistive materials 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: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:

1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory," for coating materials based on a series of bond tests per ASTM E 736.
 2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of sprayed fire-resistive material per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of sprayed fire-resistive material.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fire-resistive material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric: Glass-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated, approved by manufacturer of intumescent mastic coating fire-resistive material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
 2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
 3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Verify that concrete work on steel deck has been completed.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are completed.
- D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.

- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
- C. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of sprayed fire-resistive material. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- B. Apply sprayed fire-resistive material that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.
- D. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by sprayed fire-resistive material manufacturer for material and application indicated.
- E. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by sprayed fire-resistive material manufacturer, install body of fire-resistive covering in a single course.
- F. Spray apply fire-resistive materials 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 sprayed fire-resistive material manufacturer.
- G. Where sealers are used, apply products that are tinted to differentiate them from sprayed fire-resistive material over which they are applied.

3.4 APPLICATION, CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply concealed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
- B. Cure concealed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.5 APPLICATION, EXPOSED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Apply exposed sprayed fire-resistive material in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
- B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.
- C. Apply exposed cementitious sprayed fire-resistive materials to produce the following finish:
 - 1. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
- D. Cure exposed sprayed fire-resistive material according to product manufacturer's written recommendations.

3.6 APPLICATION, EXPOSED INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

- A. Apply exposed intumescent mastic fire-resistive coatings in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition.
- B. Apply intumescent mastic fire-resistive coating as follows:
 - 1. Install reinforcing fabric as required to obtain designated fire-resistance rating and where indicated.
 - 2. Finish: Even, spray-textured finish produced by lightly rolling flat surfaces of fire-protected members before fire-resistive material dries, to smooth out surface irregularities and to seal in surface fibers.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
 - 1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Tests and Inspections: Testing and inspecting of completed applications of sprayed fire-resistive material shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of sprayed fire-resistive material for the next area until test results for previously completed applications of sprayed fire-resistive material show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
 - 1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.
 - 2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
 - 3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and

- structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
 - a. Field test sprayed fire-resistive material that is applied to flanges of wide-flange, structural steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
 - b. If surfaces of structural steel receiving sprayed fire-resistive material are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E 736.
 5. If testing finds applications of sprayed fire-resistive material are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
- C. Remove and replace applications of sprayed fire-resistive material that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
 - D. Apply additional sprayed fire-resistive material, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.
 - E. Field inspect intumescent materials in accordance with AWCI Tech Manual 12B.
- 3.8 CLEANING, PROTECTING, AND REPAIR
- 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 sprayed fire-resistive material, according to advice of product 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.
 - C. Coordinate application of sprayed fire-resistive material with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect sprayed fire-resistive material and patch any damaged or removed areas.
 - D. Repair or replace work that has not successfully protected steel.

END OF SECTION

SECTION 078410

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for fire-resistive joint sealers.
 - 2. Section 079200 - JOINT SEALANTS for standard joint sealers.
 - 3. Division 21 - FIRE PROTECTION for fire-suppression piping penetrations.
 - 4. Division 22 - PLUMBING for piping penetrations.
 - 5. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
 - 6. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop 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 construction penetrated.
- B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated, as determined per ASTM E 814.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
- D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:
 1. Types of penetrating items.
 2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
 3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
- E. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Either a firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors" or a firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed in the UL "Fire Resistance Directory."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Through-Penetration Firestop System Schedule at the end of Part 3.
 1. Hilti, Inc.

2. BioFireShield; RectorSeal Corporation.
3. Specified Technologies, Inc. (STI).
4. 3M; Fire Protection Products Division.

2.2 FIRESTOPPING MATERIALS

- A. **Compatibility:** Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. **Materials:** Provide through-penetration firestop systems containing primary materials and fill materials which are part of the tested assemblies indicated in the Through-Penetration Firestop System Schedule at the end of Part 3. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- C. **Accessories:** Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated

2.3 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. **Surface Cleaning:** Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. 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 through-penetration firestop 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 through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.6 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

CONCRETE FLOORS		UL-CLASSIFIED SYSTEMS			
TYPE OF PENETRANT	F-RATING HR	HILTI	STI	3M	BIO-FIRE
CIRCULAR BLANK OPENINGS	1	FA 0006, CAJ 0070	C-AJ-0094, C-AJ-0100	CAJ 0009	CAJ 0056
	2	FA 0006, CAJ 0070	C-AJ-0094, C-AJ-0100	CAJ 0009	CAJ 0056
	3	CAJ 0055	C-AJ-0014	CAJ 0009	CAJ 0056
SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, CAJ 1278, FA 1017	C-AJ-1080, C-AJ-1240, F-A-1110	CAJ 1058	CAJ 1264
	2	CAJ 1226, CAJ 1278, FA 1017	C-AJ-1080, C-AJ-1240, F-A-1110	CAJ 1058	CAJ 1264
	3	CAJ 1226, CAJ 1278, FA 1017	C-AJ-1080, C-AJ-1240, F-A-1110	CAJ 1058	CAJ 1264
	4	CAJ 8095, CBJ 1034	C-AJ-1217	CAJ 1044	N/A
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, ENT)	1	CAJ 2109, CAJ 2168, FA 2054, FA 2067	C-AJ-2297, F-A-2192, F-A-2210	CAJ 2189, CAJ 2117, CAJ 2027	CAJ 2131
	2	CAJ 2109, CAJ 2168, FA 2054, FA 2067	C-AJ-2297, F-A-2192, F-A-2210	CAJ 2189, CAJ 2117	CAJ 2131
	3	CAJ 2109, CAJ 2168, FA 2054,	C-AJ-2297, F-A-2192	CAJ 2005, CAJ 2117	CAJ 2152
	4	N/A*	C-AJ-2364	N/A*	N/A
SINGLE OR BUNDLED CABLES	1	FA 3007, CAJ 3095,	C-AJ-3154, F-A-3021, F-A-3037	CAJ 3021	CAJ 3103
	2	FA 3007, CAJ 3095,	C-AJ-3154, F-A-3021, F-A-3037	CAJ 3021	CAJ 3103
	3	FA 3007, CAJ 3095,	C-AJ-3154, F-A-3021, F-A-3037	CAJ 3030	CAJ 3103
	4	N/A*	C-AJ-3154, C-AJ-3214	N/A*	N/A
CABLE TRAY	1	CAJ 4034, CAJ 4054, CAJ 4017	C-AJ-4029, C-AJ-4088	CAJ 4003	CAJ 4048
	2	CAJ 4034, CAJ 4054, CAJ 4017	C-AJ-4029, C-AJ-4088	CAJ 4003	CAJ 4048
	3	CAJ 4034, CAJ 4017	C-AJ-4029, C-AJ-4060	CAJ 4003	CAJ 4048
	4	N/A*	N/A*	N/A*	N/A

CONCRETE FLOORS (CONTINUED)		UL-CLASSIFIED SYSTEMS			
TYPE OF PENETRANT	F-RATING HR	HILTI	STI	3M	BIO-FIRE
SINGLE INSULATED PIPES	1	FA 5016, FA 5017, CAJ 5090, CAJ 5091,	C-AJ-5079, C-AJ-5087, F-A-5041	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082
	2	FA 5016, FA 5017 CAJ 5090, CAJ 5091,	C-AJ-5079, C-AJ-5087, F-A-5041	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082
	3	FA5016, CAJ 5061, CAJ 5090,	C-AJ-5079, C-AJ-5029, F-A-5041	CAJ 5024, CAJ 5017	CAJ 5006
	4	CBJ 5006	N/A*	N/A*	N/A
ELECTRICAL BUSWAY	1	CAJ 6006, CAJ 6017	C-AJ-6003, C-AJ-6019	CAJ 6001, CAJ 6002	CAJ 6026
	2	CAJ 6006, CAJ 6017	C-AJ-6003, C-AJ-6019	CAJ 6001, CAJ 6002	CAJ 6026
	3	CAJ 6006, CAJ 6017	C-AJ-6003, C-AJ-6019	CAJ 6001, CAJ 6002	N/A
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046 CAJ 7051	C-AJ-7023, C-AJ-7027	CAJ 7003, CAJ 7021	CAJ 7036
	2	CAJ 7046 CAJ 7051	C-AJ-7023, C-AJ-7027	CAJ 7003, CAJ 7021	N/A
	3	CAJ 7046 CAJ 7051	C-AJ-7023, C-AJ-7027	CAJ 7003, CAJ 7021	N/A
MIXED PENETRANTS	1	CAJ 8056, CAJ 8095, CAJ 8099	C-AJ-8093, C-AJ-8113, C-AJ-8181	CAJ 8001, CAJ 8013	CAJ 8051
	2	CAJ 8056, CAJ 8095, CAJ 8099	C-AJ-8093, C-AJ-8113, C-AJ-8181	CAJ 8001, CAJ 8013	CAJ 8051
	3	CAJ 8056, CAJ 8095, CAJ 8099	C-AJ-8093, C-AJ-8113, C-AJ-8181	CAJ 8001, CAJ 8013	CAJ 8051
	4	CAJ 8095	N/A*	N/A*	N/A

CONCRETE OR BLOCK WALLS		UL-CLASSIFIED SYSTEMS			
TYPE OF PENETRANT	F-RATING	HILTI	STI	3M	BIO-FIRE
CIRCULAR BLANK OPENINGS	1	CAJ 0055, CAJ 0070	C-AJ-0094, C-AJ-0100	CAJ 0009	CAJ 0056
	2	CAJ 0055, CAJ 0070	C-AJ-0094, C-AJ-0100	CAJ 0009	CAJ 0056
	3	CAJ 0055	C-AJ-0014	CAJ 0009	CAJ 0056
SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, CAJ 1278,	C-AJ-1080	CAJ 1058	CAJ 1264
	2	CAJ 1226, CAJ 1278,	C-AJ-1080	CAJ 1058	CAJ 1264
	3	CAJ 1226, CAJ 1278,	C-AJ-1080	CAJ 1058	CAJ 1264
	4	CAJ 8095, CBJ 1034, WJ 1042	W-J-1170	CAJ 1044	WJ 1064
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, ENT)	1	CAJ 2109, WJ 2108, WJ 2121	W-J-2076, C- AJ-2297	CAJ 2189, CAJ 2117, CAJ 2027	CAJ 2131
	2	CAJ 2109, WJ 2108, WJ 2121	W-J-2076, C- AJ-2297	CAJ 2189, CAJ 2117, CAJ 2027	CAJ2131
	3	CAJ 2109, CAJ 2168, WJ 2091	C-AJ-2297, W-J-2085	CAJ 2005, CAJ 2117, CAJ 2027	CAJ2152
	4	WJ 2091	W-J-2085, W-J-2217	N/A*	N/A
SINGLE OR BUNDLED CABLES	1	CAJ 3095, WJ 3060 WJ 3074	W-J-3090, W-J-3180	CAJ 3021	WJ 3071
	2	CAJ 3095, WJ 3060 WJ 3074	W-J-3090, W-J-3180	CAJ 3021	WJ 3071
	3	CAJ 3095, WJ 3050	C-AJ-3154, C-AJ-3214	CAJ 3030	CAJ 3103
	4	WJ 3050	C-AJ-3154, C-AJ-3214	N/A*	N/A
CABLE TRAY	1	CAJ 4034, CAJ 4054, WJ 4016,	C-AJ-4029, C-AJ-4088	CAJ 4003	CAJ 4048
	2	CAJ 4034, CAJ 4054, WJ 4016,	C-AJ-4029, C-AJ-4088	CAJ 4003	CAJ 4048
	3	CAJ 4034, WJ 8007	C-AJ-4029, W-J-4068	CAJ 4003	CAJ 4048
	4	WJ 8007	W-J-4066, W-J-4068	N/A*	N/A

CONCRETE OR BLOCK WALLS (CONT)		UL-CLASSIFIED SYSTEMS			
TYPE OF PENETRANT	F-RATING	HILTI	STI	3M	BIO-FIRE
SINGLE INSULATED PIPES	1	CAJ 5090, CAJ 5091, WJ 5042	W-J-5005, W-J-5012	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082
	2	CAJ 5090, CAJ 5091, WJ 5042	W-J-5005, W-J-5012	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082
	3	CAJ 5090, CAJ 5091,	C-AJ-5079, C-AJ-5029	CAJ 5024, CAJ 5017	CAJ 5006
	4	WJ 5028, CBJ 5006	W-J-5072	N/A*	N/A
ELECTRICAL BUSWAY	1	CAJ 6006, CAJ 6017	C-AJ-6003, C-AJ-6019	CAJ 6001, CAJ 6002	CAJ 6026
	2	CAJ 6006, CAJ 6017	C-AJ-6003, C-AJ-6019	CAJ 6001, CAJ 6002	CAJ 6026
	3	CAJ 6006, CAJ 6017	C-AJ-6003, C-AJ-6019	CAJ 6001, CAJ 6002	N/A
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046, WJ 7029, WJ 7022	W-J-7089, W- J-7005, W-J- 7092	CAJ 7003, CAJ 7021	CAJ 7036
	2	CAJ 7046, WJ 7029, WJ 7022	W-J-7089, W-J-7005, W-J-7092	CAJ 7003, CAJ 7021	CAJ 7036
	3	CAJ 7046 CAJ 7051	C-AJ-7023, C-AJ-7027	CAJ 7003, CAJ 7021	N/A
MIXED PENETRANTS	1	CAJ 8096, CAJ 8099 WJ 8007	C-AJ-8093, C-AJ-8113, C-AJ-8181	CAJ 8001, CAJ 8013	CAJ 8051
	2	CAJ 8096, CAJ 8099 WJ 8007	C-AJ-8093, C-AJ-8113, C-AJ-8181	CAJ 8001, CAJ 8013	CAJ 8051
	3	CAJ 8099 WJ 8007	C-AJ-8093, C- AJ-8113, C- AJ-8181	CAJ 8001, CAJ 8013	CAJ 8051
	4	WJ 8007	N/A*	N/A*	N/A

WOOD FLOORS		UL-CLASSIFIED SYSTEMS			
TYPE OF PENETRANT	F-RATING	HILTI	STI	3M	BIO-FIRE
METAL PIPES OR CONDUIT	1	FC 1009, FC 1059	F-C-1074	FC 1002	FC 1031
	2	FC 1009, FC 1059	F-C-1074	FC 1002	FC 1031
NON-METALLIC PIPE OR CONDUIT	1	FC 2025, FC 2126	F-C-2032, F-C-2157	FC 2024	FC 2059
	2	FC 2025, FC 2126	F-C-2044, F-C-2020	FC 2024	FC 2059
SINGLE OR BUNDLED CABLES	1	FC 3012, FC 3044	F-C-3010	FC 3017	FC 3050
	2	FC 3012	F-C-3013	FC 3017	N/A
INSULATED PIPES	1	FC 5004, FC 5036, FC 5037	F-C-5043	FC 5014	FC 5025
	2	FC 5004	F-C-5043	N/A*	FC 5025
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	FC 7013	F-C-7014, F-C-7023	FC 7001	
MIXED PENETRANTS	1	FC 8014, FC 8026	F-C-8036, F-C-8045, F-C-8029	FC 8013	N/A
	2	N/A*	F-C-8001	N/A*	N/A

GYPSUM WALLBOARD ASSEMBLIES		UL-CLASSIFIED SYSTEMS			
TYPE OF PENETRANT	F-RATING	HILTI	STI	3M	BIO-FIRE
METAL PIPES OR CONDUIT	1	WL 1054, WL 1164	W-L-1049	WL 1146	WL 1115
	2	WL 1054, WL 1164	W-L-1049	WL 1010, WL 1146	WL 1115
	4	WL 1110	W-L-1171	WL 1001	
NON-METALLIC PIPE OR CONDUIT	1	WL 2078, WL 2075, WL 2128	W-L-2100, W-L-2048, W-L-2237	WL 2088, WL 2002	WL 2133
	2	WL 2078, WL 2075, WL 2128	W-L-2100, W-L-2048, W-L-2237	WL 2088, WL 2002	WL 2133
	4	WL 2184, WL 2245	W-L-2293, W-L-2507	N/A*	
SINGLE OR BUNDLED CABLES	1	WL 3065	W-L-3210, W-L-3377	WL 3032, WL 3030	WL 3153
	2	WL 3065	W-L-3210, W-L-3377	WL 3032, WL 3030	WL 3153
	4	WL 3139	W-L-3211, W-L-3377	N/A*	
CABLE TRAY	1	WL 4011, WL 4019	W-L-4043, W-L-4079	WL 4004	WL 4032
	2	WL 4011, WL 4019	W-L-4043, W-L-4079	WL 4004	WL 4032
	4	WL 8014	W-L-4076	N/A*	
INSULATED PIPES	1	WL 5029, WL 5096	W-L-5014, W-L-5054, W-L-5091	WL 5040, WL 5001, WL 5032	WL 5062
	2	WL 5029, WL 5096	W-L-5014, W-L-5054, W-L-5091	WL 5040, WL 5001, WL 5032	WL 5062
	4	WL 5073	W-L-5158	N/A*	
NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	WL 7040, WL 7042	W-L-7026, W-L-7149, W-L-7164	WL 7008	WL 7037
	2	WL 7040, WL 7042	W-L-7026, W-L-7149, W-L-7164	WL 7008, WL 7013, WL 7016	WL 7037
MIXED PENETRANTS	1	WL 8004, WL 8013	W-L-8050, W-L-8073	WL 8010	WL 8017
	2	WL 8004, WL 8013	W-L-8050, W-L-8073	WL 8010, WL 8002	WL 8017
	4	WL 8014	N/A*	N/A*	

* No UL-Classified system is available as of August 2003. Engineer Judgment Drawing Required.

NOTES:

1. Jobsite conditions of each through-penetration firestop system must meet all details of the UL-Classified System selected.
2. If jobsite conditions do not match any UL-classified systems in the schedules above, contact firestop manufacturer for alternative systems or Engineer Judgment Drawings.
3. Coordinate work with other trades to assure that penetration-opening sizes are appropriate for penetrant locations, and vice versa.
4. For 3-hour rated gypsum walls, contact the firestop manufacturer for a UL-classified system or engineer judgment drawing.
5. The Contractor shall verify that the schedule is current at the time of construction, and that each referenced system is suitable for the intended application.

END OF SECTION

SECTION 078440

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the Work of this Section, including but not limited to fire-resistive joint systems for the following:
 - 1. Floor-to-floor joints.
 - 2. Floor-to-wall joints.
 - 3. Head-of-wall joints.
 - 4. Wall-to-wall joints.
 - 5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 078413 - PENETRATION FIRESTOPPING for firestopping.
 - 2. Section 079200 - JOINT SEALANTS for standard joint sealers.
 - 3. Division 21 - FIRE PROTECTION for fire-suppression piping penetrations.
 - 4. Division 22 - PLUMBING for piping penetrations.
 - 5. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for duct and piping penetrations.
 - 6. Division 26 - ELECTRICAL for cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: 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 assembly in which fire-resistive joint systems are installed.
- B. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
 - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- D. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.
- E. Qualification Data: For Installer.
- F. Field quality-control test reports.
- G. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration fire stop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction of a minimum of five projects with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Evidence of FMG 4991 approval is acceptable for installer qualifications, but not mandatory.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.
- D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
 - 2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
 - a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
 - b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 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. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.8 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. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, fire-resistive joint systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Fire-Resistive Joint System Schedule at the end of Part 3.
 - 1. Hilti, Inc.
 - 2. BioFireShield; RectorSeal Corporation.
 - 3. Specified Technologies, Inc. (STI).
 - 4. 3M; Fire Protection Products Division.

2.2 FIRE-RESISTIVE JOINT SYSTEMS

- A. General: 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 E 1966 or UL 2079.

- C. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.
- D. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing 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.
- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.
- B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
 1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.
- D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to joints as 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 openings 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.

3.6 TESTED (DYNAMIC) JOINT FIRESTOP SYSTEM SCHEDULE

JOINT TYPE	F-RATING	UL-CLASSIFIED SYSTEM NUMBER							
		JOINT WIDTH LESS THAN OR EQUAL TO 2"				JOINT WIDTH LESS THAN OR EQUAL TO 6"			
		HILTI	STI	3M	BIO-FIRESHIELD	HILTI	STI	3M	BIO-FIRESHIELD
CONCRETE FLOOR-TO-FLOOR	1	see note 2	see note 2	FF-D-0002	N/A**	FF-D-1026, FF-D-1039	FF-D-1008, FF-D-1025	FF-D-1002, FF-D-1003, FF-D-1004	N/A**
	2	see note 2	see note 2	FF-D-0002	N/A**	FF-D-1026, FF-D-1039	FF-D-1008, FF-D-1025	FF-D-1002, FF-D-1003, FF-D-1004	N/A**
	3	see note 2	see note 2	N/A**	N/A**	FF-D-1026, FF-D-1039	FF-D-1008, FF-D-1025	N/A**	N/A**
EDGE OF CONCRETE FLOOR SLAB-TO-WALL (also see CURTAIN WALLS & note 1))	1	see note 2	see note 2	-	N/A**	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021	FW-D-1007, FW-D-1035	FW-D-1002, FW-D-1003, FW-D-1009	FW-D-1023
	2	see note 2	see note 2	-	N/A**	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021	FW-D-1007, FW-D-1035	FW-D-1002, FW-D-1003, FW-D-1009	FW-D-1023
	3	see note 2	see note 2	-	N/A**	FW-D-1011, FW-D-1021	FW-D-1007, FW-D-1035	FW-D-1002, FW-D-1009	N/A**

CONCRETE OR BLOCK WALL TO FLAT CONCRETE SLAB FLOOR (TOP-OF-WALL)	1	HW-D-0097	HW-D-1006, HW-D-1034	HW-D-0023, HW-D-0029	HW-D-0114	HW-D-1008, HW-D-1009	HW-D-1006, HW-D-1034	HW-D-1003	HW-D-1023
	2	HW-D-0097	HW-D-1006, HW-D-1034	HW-D-0023, HW-D-0029	HW-D-0114	HW-D-1008, HW-D-1009	HW-D-1006, HW-D-1034	HW-D-1003	HW-D-1023
	3	see note 2	HW-D-1006, HW-D-1034	-	HW-D-0114	HW-D-1008		HW-D-1002, HW-D-1007	N/A**
CONCRETE OR BLOCK WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	1	HW-D-0080, HW-D-0081, HW-D-0098, HW-D-0181	HW-D-0086	HW-D-0022, HW-D-0030, HW-D-0040HW-D-0013	HW-D-0200	HW-D-1037, HW-D-1041			N/A**
	2	HW-D-0080, HW-D-0081, HW-D-0098, HW-D-0181	HW-D-0086	HW-D-0022, HW-D-0030, HW-D-0040HW-D-0013	HW-D-0200	HW-D-1037, HW-D-1041			N/A**
	3	N/A**	HW-D-0086	N/A**	N/A**	N/A**			N/A**
GYPSUM WALL TO FLAT CONCRETE SLAB FLOOR (TOP-OF-WALL)	1	HW-D-0082, HW-D-0083, HW-D-0097	HW-D-0079, HW-D-0044	HW-D-0012, HW-D-0021	HW-D-0180	N/A**	N/A**		
	2	HW-D-0082, HW-D-0083, HW-D-0097	HW-D-0079, HW-D-0044	HW-D-0012, HW-D-0021	HW-D-0180	N/A**	N/A**		
	3	N/A**	HW-D-0044	N/A**	N/A**	N/A**	N/A**		

GYPSUM WALL TO CONCRETE OVER FLUTED METAL DECK (TOP-OF-WALL)	1	HW-D-0042, HW-D-0049, HW-D-0076, HW-D-0264	HW-D-0043	HW-D-0011, HW-D-0020, HW-D-0031	HW-D-0033	N/A**	N/A**		
	2	HW-D-0042, HW-D-0049, HW-D-0076, HW-D-0264	HW-D-0043	HW-D-0011, HW-D-0020, HW-D-0031	HW-D-0033	N/A**	N/A**		
	3	HW-D-292	HW-D-0043	N/A**	N/A**	N/A**	N/A**		
CONCRETE WALL-TO-WALL	1	WW-D-0017, WW-D-0032	WW-D-1007, WW-D-1037	-	WW-D-0009	WW-D-1011, WW-D-1012	N/A**	WW-D-1003, WW-D-1004, WW-D-1010	N/A**
	2	WW-D-0017, WW-D-0032	WW-D-1007, WW-D-1037	-	WW-D-0009	WW-D-1011, WW-D-1012	WW-D-1007, WW-D-1037	WW-D-1003, WW-D-1004, WW-D-1010	N/A**
	3	-	WW-D-1007, WW-D-1037	-	WW-D-0010	WW-D-1011	WW-D-1007, WW-D-1037	WW-D-1003, WW-D-1010	N/A**
<i>CURTAIN WALLS</i> (see note 1)		JOINT WIDTH LESS THAN OR EQUAL TO 6"			JOINT WIDTH LESS THAN OR EQUAL TO 8"				
EDGE OF FLOOR TO NON-RATED ALUMINUM & GLASS CURTAIN WALL	2 hr F Rating	CW-D-2027	CW-D-2042			CW-D-2026, CW-D-2027	CW-D-2042		CW-D-2019, CW-D-2015
EDGE OF FLOOR TO NON-RATED CONCRETE/STONE SPANDREL	2 hr F Rating	CW-D-1001	CW-D-2005			CW-D-2025	CW-D-2005	CW-D-2017	
EDGE OF FLOOR TO NON-RATED CURTAIN WALL WITH GALVANIZED STEEL BACK PAN	2 Hr F Rating	N/A	CW-S-0002	N/A	N/A	N/A	CW-S-0002	N/AN/A	N/A

** Contact manufacturer for current ul-classified system or engineer judgement drawing

Notes:

1. Edge of slab, curtain wall systems are also tested by omega point labs. Contact manufacturer for additional listings.
2. Classified systems for 2" - 6" wide joints may be used for joints 2" wide and less.
3. Confirm that movement capabilities of the selected ul system meets or exceeds the specified movement range of the particular joint.
4. System performance may be affected by factors such as metal stud width, joint width or the presence of fire-proofing materials within the joint. Consult individual details for specifications and limitations.

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5. Head-of-wall systems specified only for 2- or 3-hr systems may not be suitable for masonry walls or gypsum wall assemblies with lower hourly ratings. Contact the firestop manufacturer for clarification

END OF SECTION

SECTION 079200

JOINT SEALANTS

(Part of Work of Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Joint sealants and fillers.
- B. This Section includes joint sealants for the applications specified with the products in this Section and as indicated on Drawings.
- C. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for masonry control and expansion joint fillers and gaskets.
 - 2. Section 088000 - GLAZING for glazing sealants.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
 - 4. Section 093000 – TILING for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 5. Section 095100 - ACOUSTICAL CEILINGS for sealing edge moldings at perimeters of acoustical ceilings.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Qualification Data: For Installer.
- E. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- F. 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.
- G. Field Test Report Log: For each elastomeric sealant application.
- H. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. 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 manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 4. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each application indicated below:

- a. Each type of elastomeric sealant and joint substrate indicated.
 - b. Each type of nonelastomeric sealant and joint substrate indicated.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
- a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
 - 1) 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.
4. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 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 deg F
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric 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 elastomeric sealant manufacturer agrees to furnish elastomeric 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: Five years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
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

2.1 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 sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that 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. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations.

2.2 JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Elastomeric sealants shall be nonstaining to porous substrates. Provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral-Curing Silicone Sealant:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Silicones; SilPruf LM SCS2700.
 - c. Tremco Inc.; Spectrem 1.
 - d. Pecora Corporation; 864.
 - e. May National Bondaflex Sil 290
 2. Extent of Use: Joints in exterior vertical and soffit surfaces.
- E. Multicomponent Pourable Urethane Sealant:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik Findley; Chem-Calk 550.
 - b. Meadows, W. R., Inc.; POURTHANE.
 - c. Pecora Corporation; Urexpan NR-200.
 - d. Tremco Inc.; THC-901.
 - e. May National Bondaflex PUR 2 SL
2. Extent of Use: Joints in exterior horizontal surfaces.

F. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 786 Mildew Resistant.
 - b. GE Silicones; Sanitary SCS1700.
 - c. Tremco Inc.; Tremsil 200.
 - d. May National Bondaflex Sil 100 WF
2. Extent of Use: Sanitary joints at toilet rooms.

G. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik Findley; Chem-Calk 600.
 - b. Pecora Corporation; AC-20+.
 - c. Sonneborn, BASF Building Systems; Sonolac.
 - d. Tremco Inc.; Tremflex 834.
 - e. May National Bondaflex Sil-A 700
2. Extent of Use: Non-moving joints at interior locations.

H. Solvent-Release-Curing Acrylic-Based Joint Sealant: ASTM C 1311.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Schnee-Morehead, Inc.; Acryl-R Acrylic Sealant.
 - b. Tremco Incorporated; Mono 555.
2. Extent of Use: Joints at PVC trim and panels.

2.3 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; 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. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size

and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to 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 where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, 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 concrete, masonry and unglazed surfaces of ceramic tile.
 3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous 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 metal, glass, porcelain enamel and glazed surfaces of ceramic tile.

- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on 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 with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with 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 C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type 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 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 configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

3.4 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.

3.5 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.

END OF SECTION

SECTION 080002

GLASS AND GLAZING

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 080002- GLASS AND GLAZING

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable.

- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
((always insert accurate list of sheet numbers of applicable Drawings)).

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. All Work of Section 088000 - GLAZING.

END OF SECTION

SECTION 081110

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Standard hollow-metal steel doors.
 - 2. Standard hollow-metal steel frames.
 - 3. Hollow metal doors and frames insulated for acoustical performance.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for building anchors into and grouting steel frames in masonry construction.
 - 2. Section 087100 - DOOR HARDWARE for door hardware for steel doors.
 - 3. Section 088000 - GLAZING for glazed lites.
 - 4. Section 099000 - PAINTING AND COATING for field painting steel doors and frames.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings:
 - 1. Elevations of each door design.
 - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of 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.

- 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 door hardware schedule.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- C. Fire-Rated Door, Sidelight and Transom Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Amweld Building Products, LLC.
 - 2. Ceco Door Products; an ASSA ABLOY Group Company.
 - 3. CURRIES Company; an ASSA ABLOY Group Company.
 - 4. de LaFontaine
 - 5. Mesker Door Inc.
 - 6. Pioneer Industries, Inc.
 - 7. Philipp Manufacturing Company.
 - 8. Republic Builders Products Company.
 - 9. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.
- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

- I. Glazing: Comply with requirements in Section 088000 - GLAZING.
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
 - 1. Design: Flush panel.
 - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 - b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.
 - 4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
 - 1. Fabricate frames with full profile welded joints.
 - 2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.

- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
 - 1. Fabricate frames with full profile welded joints.
 - 2. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 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. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
 - 4. 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, not less than 0.042 inch (1.0 mm) thick, and as follows:
 - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 - 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

2.7 STOPS AND MOLDINGS

- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
 - 1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 2. Glazed Lites: Factory cut openings in doors.
 3. 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.
- D. 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. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.

- 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 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 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
 - c. Compression Type: Not less than two anchors in each jamb.
 - d. 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.
7. Door Silencers: Except on weather-stripped doors, 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.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 087100 - DOOR HARDWARE.
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 - ELECTRICAL WORK.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow metal work.
 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - 2. Refer to Section 099000 – PAINTING AND COATING for field-applied coating.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 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.

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-protection-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 glazing 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 plumbness, squareness, 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 are filled with grout.
 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind 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 grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 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 Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. 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 Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

- b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch .
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply 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.
- 3.4 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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081400
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Solid-core doors with wood-veneer and medium-density overlay faces.
 2. Factory finishing for wood doors.
 3. Factory fitting flush wood doors to frames and factory machining for hardware.
 4. Louvers for flush wood doors.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 087100 - DOOR HARDWARE for hardware for wood doors.
 2. Section 088000 - GLAZING for glazing.
 3. Section 099000 - PAINTING AND COATING for field finishing of wood doors.

1.3 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. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
1. Indicate dimensions and locations of mortises and holes for hardware.
 2. Indicate dimensions and locations of cutouts.
 3. Indicate requirements for veneer matching.
 4. Indicate doors to be factory finished and finish specifications.
 5. Indicate fire ratings for fire doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."
 1. Provide AWI Quality Certification Program (QCP) labels or certificates indicating that doors comply with requirements of grades specified. Register the work under this Section with the AWI QCP.
- 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 according to NFPA 252.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 2. Warranty shall include hardware installation and replacement of glass and glazing.
 3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Flush Wood Doors:
 - a. Algoma Hardwoods Inc.
 - b. Eggers Industries; Architectural Door Division.
 - c. Lambton Doors.
 - d. Marshfield Door Systems.
 - e. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."
- B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that contain no added urea formaldehyde.
- C. Doors for Transparent Finish:
1. Grade: AWI Premium, with AWI Grade A faces.
 2. Species and Cut: Clear White Maple, quarter sawn.
 3. Match between Veneer Leaves: Slip match.
 4. Assembly of Veneer Leaves on Door Faces: Center balanced.
 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 6. Transom Match: Continuous match.
 7. Stiles: Same species as faces.
 8. Cross-Banding: 1/8 in. high density fiberboard, urea formaldehyde free.
- D. Doors for Opaque Finish:
1. Grade: Premium.
 2. Faces for Interior Doors: Medium-density overlay.
 3. Apply medium-density overlay directly to high-density hardboard crossbands.

2.3 SOLID-CORE DOORS

- A. Cores: Comply with the following requirements:
1. Particle Core: ANSI A 208.1, Grade 1-LD-2 contributes to MR 4.1 and MR 4.2.
 2. Stave Lumber Core: FSC Certified contributes to MR 7 and IEQ 4.4.
 3. Agrifiber Core: ANSI A 208.1, Grade 1-LD-2 contributes to MR 4.1, MR 4.2, MR 6, and IEQ 4.4.
 4. Structural Composite Lumber Core: Timberstrand LSL contributes to IEQ 4.4.
 5. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated or where light or louver cutouts exceed 40% of the door area.
- B. Interior Veneer-Faced Doors:

1. Construction: Five plies, hot-pressed, with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
 - a. Fire Retardant Mineral Core, with added urea formaldehyde free cross-banding, **contributes to IEQ 4.4.**
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

2.4 LOUVERS AND LIGHT FRAMES

- A. Wood Louvers: Door manufacturer's standard solid-wood, chevron-style, louvers, unless otherwise indicated. Species to match veneer.
- B. Fire Door Louvers (**not required on 20 min. doors**): Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of one and one-half hours and less.
 1. Metal and Finish: Galvanized steel, 0.0396 inch thick, hot-dip zinc coated and factory primed for paint finish.
- C. Wood Beads for Light Openings in Wood Doors:
 1. Wood Species: Same species as door faces.
 2. Profile: Manufacturer's standard shape.
 3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.
- D. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 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, DHI A115-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining. Drill pilot holes for screws for butt hinges and lock fronts at the factory.
 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.
- 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 meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Louvers: Factory install louvers in prepared openings.
- 2.6 SHOP PRIMING
- A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Section 099000 - PAINTING AND COATING.
- 2.7 FACTORY FINISHING
- A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.
- B. Finish doors at factory that are indicated to receive transparent finish. Factory prime and prepare for field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
1. Grade: Premium.
 2. Finish: Manufacturer's standard catalyzed polyurethane finish with performance comparable to AWS System 11. Provide two finish coats.
 3. Staining: As selected by Architect from manufacturer's full range.
 4. Effect: Semifilled finish.
 5. Sheen: Satin.
- D. Opaque Finish:
1. Grade: Premium.
 2. Finish: Manufacturer's standard conversion varnish finish with performance comparable to AWS System 5.
 3. Color: As selected by Architect from manufacturer's full range.
 4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 - DOOR HARDWARE.

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

C. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083110

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Access doors and frames for walls and ceilings.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for blocking out openings for access doors and frames in concrete.
 - 2. Section 042000 - UNIT MASONRY for anchoring and grouting access door frames set in masonry construction.
 - 3. Section 087100 - DOOR HARDWARE for rim cylinder locks and master keying.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- D. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- E. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

- F. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain [each type of access door and frame through one source from a single manufacturer.
- B. 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 per 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 for vertical access doors and frames.
 - 2. ASTM E 119 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
 - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: Electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.2 STAINLESS-STEEL MATERIALS

- A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
 - 1. Finish: Directional Satin Finish, No. 4.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Acudor Products, Inc.
 - 2. Babcock-Davis; A Cierra Products Co.
 - 3. Dur-Red Products.
 - 4. J. L. Industries, Inc.
 - 5. Karp Associates, Inc.
 - 6. Larsen's Manufacturing Company.
 - 7. Milcor Inc.
 - 8. Nystrom, Inc.
- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
 - 4. Hinges: Continuous piano.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.
- C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
 - 1. Locations: Wall and ceiling surfaces.
 - 2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
 - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.
 - 4. Hinges: Concealed pivoting rod hinge.
 - 5. Lock: Cylinder.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE.
- D. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel at typical areas and from stainless-steel sheet at toilets and wet areas.
 - 1. Locations: Wall surfaces.
 - 2. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.

4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Automatic Closer: Spring type.
7. Lock: Self-latching device with cylinder lock.
 - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 087100, DOOR HARDWARE

2.4 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 panels to types of supports indicated.
 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
 1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For cylinder lock, furnish two keys per lock and key all locks alike.
 2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

- 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

SECTION 083310

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Electric-motor-operated overhead coiling doors.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
 - 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 3. Section 099000 - PAINTING AND COATING for field-applied paint finish.
 - 4. Division 26 - ELECTRICAL for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Load: Uniform pressure (velocity pressure) required by Code but not less than 20 lbf/sq. ft. acting inward and outward.
- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 20,000 cycles and for 10 cycles per day.

1.4 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs.

2. Fire-Rated Doors: Include description of fire-release system including testing and resetting instructions.

B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

C. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

D. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

C. Fire-Test-Response Characteristics: Provide assemblies complying with NFPA 80 that are identical to door and frame assemblies tested for fire-test-response characteristics per UL 10b and NFPA 252, and that are listed and labeled for fire ratings indicated by UL, FMG, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction.

D. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cornell Iron Works.
2. Overhead Door Corp.
3. Raynor Garage Door Co.

2.2 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling door curtain of interlocking slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel (SS) sheet; complying with ASTM A 653/A 653M, G90 (Z275) coating designation.

- a. Minimum Base-Metal (Uncoated) Thickness: 0.0209 inch.
 - b. Flat profile slats.
 2. Inside Curtain Slat Face: To match material of outside metal curtain slat.
- B. Endlocks and Windlocks for Service Doors: Malleable-iron casings galvanized after fabrication, secured to curtain slats with galvanized rivets or high-strength nylon. Provide locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Endlocks for Counter Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- D. Bottom Bar for Service Doors: Consisting of 2 angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; galvanized, stainless-steel, or aluminum extrusions to suit type of curtain slats.
- E. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, either stainless steel or aluminum extrusions to suit type of curtain slats.
- F. Curtain Jamb Guides for Service Doors: Fabricate curtain jamb guides of steel angles or channels and angles, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Build up units with not less than **3/16-inch-** (thick galvanized steel sections complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Slot boltholes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.
- G. Curtain Jamb Guides for Counter Doors: Fabricate curtain jamb guides of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

- A. Hood: Form to act as weatherseal and entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and provide fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sagging.
1. Fabricate hoods for steel doors of minimum 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.
 2. Include automatic drop baffle to guard against passage of smoke or flame.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.
1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 2. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene at doorjamb for a weathertight installation.
- C. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks. Lock cylinder is specified in Section 087100 - DOOR HARDWARE.

- D. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.
- E. Provide automatic-closing device that is inoperative during normal door operations, with governor unit complying with requirements of NFPA 80 and with an easily tested and reset release mechanism, and designed to be activated by building fire alarm and detection system and door-holder-release devices.

2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate.

2.5 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
- B. Comply with NFPA 70.
- C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging chain and sprocket operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.
- F. Door-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft-type door operator unit consisting of electric motor, drive, and chain and sprocket secondary drive.

- G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors complying with NEMA MG 1; with overload protection; sized to start, accelerate, and operate door in either direction from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or service factor.
 - 1. Type: Polyphase, medium-induction type.
 - 2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
- H. Remote-Control Station: Provide momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
 - 1. Provide interior units, full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- I. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor capable of protecting full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
- J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- K. Provide electric operators with ADA-compliant audible alarm and visual indicator lights.
- L. Radio Control: Provide radio control system consisting of the following:
 - 1. Three-channel universal coaxial receiver to open, close, and stop door, one per operator.
 - 2. Multifunction remote control.
 - 3. Remote antenna mounting kit.

2.6 FINISHES

- A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Powder-Coat Finish: Manufacturer's standard powder-coat finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
 - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install coiling doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.
 - 1. Install fire-rated doors to comply with NFPA 80.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

3.3 STARTUP SERVICES

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Test door closing when activated by detector or alarm-connected fire-release system. Reset door-closing mechanism after successful test.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 083436
DARKROOM DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Revolving darkroom doors, handicap accessible.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 09260, Gypsum Board Assemblies.
- C. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of darkroom door indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show fabrication and installation details of darkroom doors. Include plans, elevations, sections, details, and attachments to other work.

PART 2 - PRODUCTS

2.1 REVOLVING DARKROOM DOORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Consolidated Door Corp., Chicago, IL 60632.

2. ESECO Speedmaster, Cushing, OK 74023.
 3. Kreolab Inc., a division of Dunning Photo Equipment, Inc., Bixby, OK 74008.
- B. Door: Inner and outer cylinder constructed of one piece black matte finish acrylonitrile butadiene styrene (ABS) 0.090 inch minimum thickness.
- C. Manufacturer's standard steel and/or aluminum reinforcing and attachment components for complete installation.
- D. Light Seals: Manufacturer's standard felt and neoprene light seals.
- E. Hardware: Manufacturer's standard push-out or pop-out emergency exit hardware.
1. Provide internal handrails, external finger grips and fluorescent markers.
- F. Finish Flooring: Manufacturers standard rubber flooring materials, black color.

2.2 FABRICATION

- A. General: Provide darkroom door assemblies manufactured as integral units ready for installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing darkroom doors.
- B. Coordinate rough openings in partitions to assure proper fit and finish.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.

END OF SECTION

SECTION 084113

ALUMINUM-FRAMED ENTRANCES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Exterior and interior manual-swing aluminum doors for installation in curtain wall framing.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
 - 2. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for door framing.
 - 3. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 4. Section 088000 - GLAZING for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Dimensional tolerances of building frame and other adjacent construction.
 - 4. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred 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 thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.

- g. Failure of operating units to function properly.
 - B. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
 - C. Deflection of Framing Members:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below to less than 1/8 inch and clearance between members and operable units directly below to less than 1/16 inch.
 - D. 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.
 - E. Air Infiltration Test: Test unit in accordance with ASTM E 283, as follows:
 - 1. Static Air Pressure Difference: 1.567 psf for doors.
 - 2. Performance: Maximum air leakage shall not exceed the following: glazed entrance door units, 0.3 cfm/sf of other areas.
 - F. Water Leakage Test: Test fixed framing system in accordance with ASTM E 331.
 - 1. Test Pressure: 8 psf.
 - 2. Performance: No leakage as defined in test method at specified test pressure. No uncontrolled water penetrating system or appearing on normally exposed interior surfaces.
 - G. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
 - H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 48 for doors when tested according to AAMA 1503.
- 1.4 SUBMITTALS
- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
 - B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
 - C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include structural analysis data signed and sealed by the qualified professional engineer registered in the jurisdiction where the Project is located, responsible for their preparation.
 2. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
 3. Include details of provisions for system expansion and contraction and for draining moisture occurring within the system to the exterior.
 4. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems.
- G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
1. U-value.
 2. Solar heat-gain coefficient.
- H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- I. Warranties: Special warranties specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.
- B. Accessible Entrances: Comply with **Massachusetts Architectural Access Board** and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
- 1.6 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. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Doors, Wide Stile, 2 inch thick with 5 inch wide top rail and stiles, and 10 inch bottom rail:
 - a. EFCO, a Pella Company, D-518 DuraStile.
 - b. Kawneer North America, equal.
 - c. Approved equal.

2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. Structural Profiles: ASTM B 308/B 308M.
 - 5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: With manufacturer's standard 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 A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermal-break.
- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 - GLAZING.

B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.5 DOORS

A. Doors: Manufacturer's standard glazed doors, for manual swing operation.

1. Door Construction: Mechanical clip fastening, SIGMA deep penetration plus welds and 1-1/8 inch long fillet welds inside and outside of all four corners. Glazing stops shall be hook-in type and EPDM glazing gaskets reinforced with non-stretchable cord.

2.6 DOOR HARDWARE

A. General: Provide door hardware in accordance with requirements of Section 087100 – Door Hardware.

B. Weather Stripping: Provide weatherstripping and astragals for full perimeter of doors including door bottoms and meeting rails.

2.7 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Section 072100 - THERMAL INSULATION.

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 - JOINT SEALANTS.

C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form aluminum shapes before finishing.

- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Door Frames: Reinforce as required to support loads imposed by door operation and for installing 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.
- D. Doors: Reinforce doors as required for installing hardware.
 - 1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- E. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Provide custom color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. 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 plumb and true in alignment with established lines and grades, without warp or rack.

D. Install glazing as specified in Section 088000 - GLAZING.

E. Entrances: Install to produce smooth operation and tight fit at contact points.

1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

F. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum 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.
3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

3.3 ADJUSTING

A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.

1. For 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.

END OF SECTION

SECTION 084410

GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Glazed aluminum-framed curtain wall systems, operable vents, exterior sunshades, interior light shelves, accessories, and cap extensions.
 2. Glass and glazing for the work of this Section, as specified in Section 088000 - GLAZING.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 053100 - STEEL DECKING for perimeter pour stop at slabs.
 2. Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS for perimeter fire-containment systems (safing insulation) field installed with glazed aluminum curtainwall systems.
 3. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with glazed aluminum curtain-wall systems and for sealants to the extent not specified in this Section.
 4. Section 084110 - ALUMINUM-FRAMED ENTRANCES for entrance doors.
 5. Section 089000 - LOUVERS AND VENTS for units installed with glazed aluminum curtainwall systems.
- D. Related Requirements: Refer to the following Sections for technical requirements relating to Work of this Section:
1. Section 079200 - JOINT SEALANTS for sealant requirements to the extent not specified in this Section.
 2. Section 088000 - GLAZING for glazing requirements to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide glazed aluminum curtain-wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:

1. Structural loads.
 2. Thermal movements.
 3. 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.
 4. Dimensional tolerances of building frame and other adjacent construction.
 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred 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 thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
- B. Structural Loads: Wind and seismic loads as indicated on the Structural Drawings, but not less than that required by Code.
- C. Structural-Test Performance: Provide glazed aluminum curtain-wall systems tested according to ASTM E 330 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 Duration: As required by design wind velocity but not less than 10 seconds.
- D. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to $1/175$ of clear span for spans up to 13 feet 6 inches, and to $1/240$ of clear span plus $1/4$ inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to $3/4$ inch, whichever is less.
 2. Deflection Parallel to Glazing Plane: Limited to $1/360$ of clear span or $1/8$ inch, whichever is smaller, amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and which reduces edge clearance between framing members and glazing or other fixed components to less than $1/8$ inch.
- E. Story Drift: Provide glazed aluminum curtain-wall systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings.
 2. Test Performance: No glass breakage, anchor failures, or structural damage when tested according to AAMA 501.4.
- F. Thermal Movements: Provide glazed aluminum curtain-wall 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.

- G. Air Infiltration: Provide glazed aluminum curtain-wall systems with maximum air leakage of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
- H. Water Penetration Under Static Pressure: Provide aluminum glazed curtain-wall systems that do not evidence water penetration when tested according to ASTM E 331 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 12 lbf/sq. ft.
 - 1. Maximum Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.
- I. Condensation Resistance: Provide glazed aluminum curtain-wall systems with condensation-resistance factor (CRF) of not less than 70 when tested according to AAMA 1503.
- J. Solar Heat-Gain Coefficient: Provide units with a whole-unit SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.
- K. Thermal Transmittance: Provide window units that have a U-value as required by Code rated in BTU/hour/sq. ft./degrees F at 15-mph exterior wind velocity, when tested in accordance with AAMA 1503.1. Test unit to be 4 ft. x 6 ft. Submit proof of compliance with submittals as specified.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication and assembly of glazed aluminum curtain-wall systems.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer licensed in the state the project is located, responsible for their preparation.
 - 2. Include structural analysis of story drift and deflection from anticipated live loads, and determination whether head receptors are required.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.

- F. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that units as glazed for this Project meet or exceed Code requirements for the following:
 - 1. U-value.
 - 2. Solar heat-gain coefficient.
- G. Welding certificates.
- H. Qualification data for Installer.
- I. Field quality-control test reports.
- J. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.
- B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the state the project is located, and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of curtain wall framing that are similar to those indicated for this Project in material, design, and extent.
- 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.
- E. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code-Aluminum."
- F. Installation Sequence Conference: Conduct conference at Project site to review sequence of installation of curtain wall systems, including installation of joint sealants, flashing, and glass. Conference shall be attended by all installers of applicable components.
- G. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as indicated on Drawings.
 - 2. Build mockup in sequence recommended by manufacturer including installation of joint sealants, flashing and glass.
 - 3. The construction of the mockup shall be observed by all tradesmen constructing the curtain wall system.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to glazed aluminum curtain-wall systems including, but not limited to, the following:

1. Review structural load limitations.
2. Review installation sequence, including installation of sealants, flashing, and glass.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for glazed aluminum curtain-wall systems by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating glazed aluminum curtain-wall systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of glazed aluminum curtain-wall systems that do not comply with requirements or that deteriorate as defined in this Section 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. Deterioration of metals and other materials beyond normal weathering.
 - d. Water leakage.
 - e. Failure of operating components to function normally.
 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Curtainwall - Pressure Plate Shear Block System with Operable Vents:
 - a. EFCO, a Pella Company, S-5900, Thermal.
 - b. Kawneer North America, 1600-UT-1.
 - c. United States Aluminum, 3250.
 - d. Wausau, Superwall.

2.2 FRAMING SYSTEMS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209
 - 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.

- B. Steel Reinforcement: With manufacturer's standard 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 A 36/A 36M.
 - 2. Cold-Rolled Sheet and Strip: ASTM A 611.
 - 3. Hot-Rolled Sheet and Strip: ASTM A 570/A 570M.

- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

- D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Where acceptable, use exposed fasteners with countersunk Phillips screw heads.
 - 4. Finish exposed portions to match framing system.
 - 5. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.

- E. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

- F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

- G. Framing Sealants: As recommended by manufacturer for joint type.

2.3 GLAZING SYSTEMS

- A. Glazing: Provide insulating-glass units in accordance with requirements in Section 088000 - GLAZING.

- B. Glazing Gaskets: Manufacturer's standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric types.

2.4 INSULATED SPANDREL PANELS

- A. Insulated Spandrel Panels: Laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
 - 1. Overall Panel Thickness: 1 inch.
 - 2. Exterior and Interior Skin: Aluminum.
 - a. Thickness: Manufacturer's standard for finish and texture indicated.
 - b. Finish: Matching framing system.
 - c. Texture: Smooth.
 - d. Backing Sheet: Manufacturer's standard.
 - e. Thermal Insulation Core: Manufacturer's standard.

2.5 OPERABLE VENTS

- A. Operable Vents: Provide WV410 Operable Vent as manufactured by EFCO, or approved equal.
- B. Hardware Requirements: Provide hardware that complies with AAMA/NWWDA 101/I.S.2.
- C. Provide crank type hardware for awning type operable windows. Wickets are not permitted.
- D. Design operable vents and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable exterior sash or ventilator.
- E. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
 - 1. Aluminum Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet with minimum wall thickness as required for class indicated.
 - 2. Finish: Match aluminum window members.
- F. Stainless-Steel Wire Fabric: 18-by-16 mesh of 0.009-inch-diameter, nonmagnetic stainless-steel wire, Type 304 or 316, complying with FS RR-W-365, Type VI. Screens shall be painted black or gray as selected by Architect.

2.6 ACCESSORY MATERIALS

- A. Perimeter Fire-Containment Systems (Safing Insulation): Specified in Section 07840 - FIRESTOPPING.
- B. Insulating Materials: Specified in Section 072100 - THERMAL INSULATION.
- C. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- D. Mullion Cap Extensions and Covers: Provide #19HO, 3" deep extensions, and #12VI, 7-3/4" mullion covers as manufactured by EFCO or approved equal.
- E. Sunshades: Provide sunshades from same manufacture and material as curtain wall system. Size and profile as indicated on drawings.

1. Basis of Design: Provide E-Shade Exterior Sun Control Devices as manufactured by EFCO, or approved equal.
 2. Custom Sunshades: Provide custom sunshades in sizes and configurations as indicated on drawings.
- F. Light Shelves: Provide interior light shelves from same manufacturer as curtain wall system. Light shelves shall be constructed of extruded aluminum chassis with aluminum composite material panels in colors as selected by Architect. Fascia shall be in profile as selected by Architect.
1. Basis of Design: Provide E-Lite Interior Light Shelf as manufactured by EFCO, or approved equal.
 - a. Provide hole and grommet for window treatments.

2.7 FABRICATION

- A. Form aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 1. Sharp profiles, straight and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Internal guttering systems or other means to drain water passing joints, condensation occurring 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 prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
- C. Curtain wall assembly shall utilize manufacturer's "shear block" system.
- D. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 OPERABLE VENT FABRICATION

- A. General: Fabricate aluminum operable vents, in sizes indicated, that comply with AAMA/NWWDA 101/I.S.2 for performance class and performance grade indicated. Include a complete system for assembling components and anchoring operable vents.
- B. Thermally Improved Construction: Fabricate aluminum operable vents with an integral, concealed, low-conductance thermal barrier; located between exterior materials and operable vent members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.

- E. Factory-Glazed Fabrication: Glaze aluminum operable vents in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.
- F. Seal corners and joints in glazing gaskets on cap bead glazing gaskets.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, with color coat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Provide custom color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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 nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. 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 the system to exterior.

- D. Install components plumb and true in alignment with established lines and grades.
- E. Install glazing as specified in Section 088000 - GLAZING.
- F. Coordinate with sealants and installation of perimeter sealants which is specified in Section 079200 - JOINT SEALANTS.
- G. Coordinate with insulation and installation of insulation which is specified in Section 072100 - THERMAL INSULATION.
- H. Coordinate with materials and installation for perimeter fire-containment systems (safing insulation) which is specified in Section 078440 - FIRE-RESISTIVE JOINT SYSTEMS.
- I. Erection Tolerances: Install glazed aluminum curtain-wall systems to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet ; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet ; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or greater, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.3 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. Testing Services: Testing and inspecting of representative areas to determine compliance of installed system with specified requirements shall take place as follows and in successive stages 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 under Part 1 "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft. of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft.
 - 2. Water Penetration: Areas shall be tested according to ASTM E 1105 at minimum cyclic static-air-pressure difference of 0.67 times the pressure specified under Part 1 "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. and shall not evidence water penetration.
 - 3. Water Spray Test: After the installation of minimum area of 75-feet-by-2-story glazed aluminum curtain-wall system has been completed but before installation of interior finishes has begun, a 2-bay area of system designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.

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- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 086200
PLASTIC UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Prefabricated, plastic unit skylights at roof.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 7 for roofing and joint sealants.

1.3 SUBMITTALS

- A. Product Data: Submit complete manufacturer's product data to Architect for approval, consisting of complete product description and specifications, complete test data and technical characteristics, installation instructions, complete maintenance instructions, and other pertinent technical data required for complete product and product use information.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Submit complete shop drawings of all work of this Section to Architect for approval, showing large scale details of construction and methods of installation and anchorage, including types, sizes, thicknesses, shapes, and finishes of all materials; anchorage; closures; flashings; sealing; and relationship to surrounding work by other trades. Sufficient typical and special conditions shall be shown to fully establish the design, quality, character, and weathertight integrity of the proposed installation.

1.4 QUALITY ASSURANCE

- A. The manufacturer shall be responsible for the configuration, fabrication, and performance of the unit skylights, in general conformance with the Contract Documents.

- B. The manufacturer shall be able to identify at least five projects in the regional area where unit skylights of similar type and size have been installed and have performed satisfactorily since their installation, for a period of at least the last ten consecutive years.

1.5 TESTS AND PERFORMANCE REQUIREMENTS

- A. Manufacturer's Standard Tests: Provide manufacturer's standard test data showing compliance with code requirements. Provide specified tests if manufacturer's standard skylight units have been modified, or when custom skylights are used.
- B. Skylight system shall be designed for design loads for snow, wind, etc., established by the governing laws and the applicable building code, with a maximum deflection of $L/175$ of the unsupported span of any member, and without cracking or breakage of acrylic, permanent deformation of any member, exceeding of the ultimate tensile strength of any member, or failure of any fastening or anchor.
 - 1. Plastic unit skylights shall not transmit any horizontal loads to structure.

1.6 COORDINATION

- A. Coordinate work of this Section with work of other trades affecting, or affected by, this work to assure the steady progress of all the work of the Contract.
- B. Before proceeding with installation work inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section, and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Package and deliver all materials, and store and handle in such manner, as to assure complete protection of all materials from damage.
- B. Store skylights several inches above the ground, blocked and under cover to prevent warping. Clean all aluminum and panels before installation, and maintain all joint surfaces thoroughly clean until sealants are applied.

1.8 WARRANTY

- A. Include written warranty, signed by manufacturer, installer and Contractor, covering defects of materials and workmanship for a period of ten years from the date of Substantial Completion of Project.
- B. Include manufacturer's standard written warranty covering defects of insulating skylight for a period of ten years against breakage, delamination, or seal failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products of one of the following, that meet or exceed requirements specified:
 - 1. Bristolite Skylights.
 - 2. Fisher Skylights, Inc.
 - 3. Naturalite Skylight Systems; Oldcastle Glass Engineered Products.

4. Super Sky Products, Inc.
5. Wasco.

2.2 MATERIALS

A. Skylights shall be prefabricated.

1. Sizes: As indicated on the Drawings.
2. Aluminum members shall be extruded 6063 aluminum conforming to ASTM B 221, with a minimum thickness of 0.094 in.
3. Cap fasteners shall be 1/4 in. diameter stainless steel with stainless steel and neoprene sealing washers, spaced a maximum of 12 in. o.c.
4. Internal fasteners shall be stainless steel.
5. Glazing seal shall be butyl sealant tape to allow for thermal movement of acrylic glazing.
6. Acrylic shall be double glazed type, clear.
7. Glazing Performance Requirements: Comply with minimum requirements of ASHRAE 90.1-2004, and as follows:
 - a. U-value: 0.9 min.
 - b. Solar Heat Gain Coefficient (SHGC): 0.62 min.
8. Curb: Self-flashing curb, 18 in. high.
9. Finish: Finish shall be selected by Architect from manufacturer's standard finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Plastic unit skylights shall be installed in strict accordance with the approved shop drawings and the manufacturer's printed installation instructions by the skylight manufacturer utilizing his own fully experienced, adequately supervised, erection crews. Installation shall be complete in all respects, including all framing and all related aluminum closures, flashings, fillers, fastenings, anchors, sealing, required for a complete weathertight installation, including sealing between the skylight system components and the surrounding construction.
- B. Provide positive and adequate fastening and anchorage of all components, including fastening into existing construction. Work shall not void the warranty provisions of existing roof construction.
- C. Contact surfaces between aluminum and dissimilar materials shall be protected with coating of bituminous mastic or application of nonabsorptive, dielectric tape for prevention of electrolytic action and corrosion. Do not use bituminous mastic where it might contaminate a joint or surface to receive sealant.

3.3 SEALING

- A. Do all metal-to-metal sealing required to assure thoroughly weathertight installations throughout, as recommended by sealant manufacturer and conforming to the general procedures specified under Section 079200, Joint Sealants.

3.4 PROTECTION AND CLEANING OF ALUMINUM

- A. Protect finished metal surfaces from damage during fabrication, shipping, storage, and erection, and from then until acceptance by Owner.
- B. Clean all metal and acrylic surfaces promptly after installation. Remove excess sealant, dirt, and other substances.

3.5 PROTECTION AND CLEANING OF ACRYLIC

- A. Replace all acrylic which is broken, cracked, or chipped prior to time of final acceptance of Project by Owner.
- B. Clean acrylic surfaces promptly after installation, exercising care to avoid damage to same.

END OF SECTION

SECTION 086300

METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Aluminum-framed skylights with glass retained by field-installed pressure caps on four sides.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 076200 - SHEET METAL FLASHING AND TRIM for metal flashings installed at perimeters of assemblies.
 - 2. Section 079200 - JOINT SEALANTS for sealants installed at perimeters of metal-framed skylights.
 - 3. Section 088000 - GLAZING for glass units installed in metal-framed skylights.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide metal-framed skylights, including anchorage, capable of withstanding, without failure, the effects of the following:
 - 1. Structural loads.
 - 2. Thermal movements.
 - 3. Movements of supporting structure.
 - 4. Dimensional tolerances of building frame and other adjacent construction.
- B. Failure includes the following:
 - 1. Deflection exceeding specified limits.
 - 2. Water leakage.
 - 3. Thermal stresses transferred to building structure.
 - 4. Noise or vibration created by wind and thermal and structural movements.

5. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 6. Loosening or weakening of fasteners, attachments, and other components.
 7. Sealant failure.
- C. Structural Loads: Wind loads, snow loads, concentrated live loads and seismic loads as required by Code.
- D. Deflection of Framing Members:
1. Deflection Normal to Glazing Plane:
 - a. Spans Up to 20 Feet: Limited to 1/175 of clear span or 1 inch whichever is smaller.
 - b. Spans Exceeding 20 Feet: Limited to 1/240 of clear span.
 - c. Glass Edge Deflection: Limit edge deflection of individual glass lites to 3/4 inch.
 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch whichever is smaller and amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
- E. Lateral Bracing of Framing Members: Compression flanges of flexural members are laterally braced by cross members with minimum depth equal to 50 percent of flexural member that is braced. Glazing does not provide lateral support.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. 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.
- 1.4 PERFORMANCE TESTING
- A. Provide metal-framed skylights that comply with test-performance requirements indicated, as evidenced by reports of tests performed on manufacturer's standard assemblies.
- B. Structural-Performance Test: ASTM E 330.
1. Performance at Design Load: When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. Performance at Maximum Test Load: 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 supporting members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity but not less than 10 seconds.
- C. Air-Infiltration Test: ASTM E 283.
1. Minimum Static-Air-Pressure Difference: 1.57 lbf/sq. ft.
 2. Maximum Air Leakage: 0.06 cfm/sq. ft.
- D. Test for Water Penetration under Static Pressure: ASTM E 331.

1. Minimum Static-Air-Pressure Difference: 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Water Leakage: None.

E. Test for Water Penetration under Dynamic Pressure: AAMA 501.1.

1. Dynamic Pressure: 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft.
2. Water Leakage: No uncontrolled water penetrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained to exterior and cannot damage adjacent materials or finishes is not considered water leakage.

1.5 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal-framed skylights.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other work.
 1. Include structural analysis data signed and sealed by the qualified professional engineer, licensed in the jurisdiction where the Project is located, responsible for their preparation.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each framing intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 1. Joinery.
 2. Anchorage.
 3. Expansion provisions.
 4. Glazing.
 5. Flashing and drainage.
- F. Field quality-control test and inspection reports.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for metal-framed skylights.
- H. Maintenance Data: For metal-framed skylights to include in maintenance manuals.
- I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Entity capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 699 for testing indicated.

- C. Product Options: Information on Drawings and in Specifications establishes requirements for skylights' 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 testing conducted by an independent testing agency and in-service performance.
- D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal-framed skylights 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. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Adhesive or cohesive sealant failures.
 - e. Water leakage.
 - 2. Warranty Period: Ten years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
 - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 - 2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cherry Hill, Inc.
 - 2. SuperSky
 - 3. LinEI Signature.
 - 4. Oldcastle BuildingEnvelope
 - 5. Wasco Products, Inc.

2.2 FRAMING SYSTEMS

- A. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
 - 4. CHPS Requirement: Use minimum post-consumer recycled content of 20%.
- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing. Include snap-on aluminum trim that conceals fasteners.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Anchors, Fasteners, and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding; compatible with adjacent materials.
 - 1. At pressure caps, use ASTM A 193/A 193M, 300 series stainless-steel screws.
 - 2. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
 - 3. Exposed Fasteners:
 - a. Use exposed fasteners with countersunk Phillips screw heads.
 - b. Finish exposed portions to match framing system.
 - 4. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Anchor Bolts: ASTM A 307, Grade A hot-dip zinc coating, ASTM A 153/A 153M, Class C.
- F. Concealed Flashing: Manufacturer's standard, corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Exposed Flashing and Closures: Manufacturer's standard aluminum components not less than 0.040 inch thick.
- H. Framing Gaskets: Manufacturer's standard
- I. Framing Sealants: As recommended in writing by manufacturer.

2.3 GLAZING SYSTEMS

- A. Glazing: As specified in Section 088000 - GLAZING.
- B. Spacers, Setting Blocks, and Gaskets: Manufacturer's standard elastomeric types.
- C. Glazing Sealants: As recommended in writing by manufacturer.
 - 1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other components with which it comes in contact; and recommended in writing by structural- and weatherseal-sealant and metal-framed skylight manufacturers for this use.

- a. Color: Matching structural sealant.

2.4 ACCESSORY MATERIALS

- A. Insulating Materials: Specified in Section 072100 - THERMAL INSULATION.
- B. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.5 FABRICATION

- A. Fabricate aluminum components before finishing.
- B. Fabricate aluminum 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. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight 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.
- C. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- D. Reinforce aluminum components as required to receive fastener threads.
- E. Weld aluminum components in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- F. Light Tubes: Fabricate as indicated on the Drawings.

2.6 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: As selected by Design Professional from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection: Where aluminum will contact dissimilar materials, protect against galvanic action by painting contact surfaces with bituminous paint or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.

C. Install continuous aluminum sill closure with weatherproof expansion joints and locked and sealed or welded corners. Locate weep holes at rafters.

D. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within skylight to exterior.

E. Install components plumb and true in alignment with established lines and elevations.

F. Install glazing in accordance with requirements specified in Section 088000 - GLAZING.

G. Install insulation materials as specified in Section 072100 - THERMAL INSULATION.

H. Erection Tolerances: Install metal-framed skylights to comply with the following maximum tolerances:

1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet but no greater than 1/2 inch over total length.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test and inspection reports.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed skylights with specified requirements shall take place as follows and in successive stages 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. ASTM C 1401 recommendations for quality-control procedures.
2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.

a. Test Procedures: Test under cyclic static air pressure.

- b. Water Penetration: None.
- 3. Water-Spray Test: Before installation of interior finishes has begun, skylights shall be tested according to AAMA 501.2 and shall not evidence water penetration.
- C. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION

SECTION 087100

FINISH HARDWARE

Part 1--General

1.01 PROVISIONS INCLUDED

- A. The general provisions of the Contract, including General and Supplementary General Conditions, and Division 1 General Requirements, apply to this section.

1.02 SUMMARY

- A. Work included: Furnish and install hardware for all doors except as noted on the door schedule and/or drawings, including electrified hardware components required for security doors. The hardware shall include the furnishing of necessary and special screws, regular and special bolts, expansion shields, drop plates, and other devices necessary for the proper application of the hardware.

1. Furnish wiring diagrams with theory of operation to electrical contractor for use in installing electrical hardware products.

2. Electrical contractor to run all wiring and make all final connections for electrified hardware. Hardware supplier shall be responsible to furnish all wiring diagrams to operate electrified hardware as well as the operation sequence. Access control material and electrified hardware to interface at junction boxes.

3. Provide hardware supplier with schedule of door and frame supplier(s) to review related work to ensure hardware will be properly reinforced and applied in accordance with each manufacturers instructions.

- B. Construction keying.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 081110 - Hollow Metal Doors and Frames
2. Section 081400 – Flush Wood Doors
3. Section 083100 – Access Doors and Frames
4. Section 083300 – Overhead Coiling Doors
5. Section 083610 – Sectional Doors
6. Section 084110 – Aluminum-Framed Entrances and Storefronts

1.03 REFERENCE STANDARDS

- A. Standards

ANSI/BHMA A156.1-2006 Butts and Hinges
ANSI/BHMA A156.3-2001 Exit Devices

ANSI/BHMA A156.4-2000 Door Controls – Closers
ANSI/BHMA A156.5-2001 Auxiliary Locks and Associated Products
ANSI/BHMA A156.6-2005 Architectural Door Trim
ANSI/BHMA A156.7-2003 Template Hinge Dimensions
ANSI/BHMA A156.8-2005 Door Controls – Overhead Stops & Holders
ANSI/BHMA A156.13-2005 Mortise Locks / Latches
ANSI/BHMA A156.15-2006 Closer/Holder/Release Devices
ANSI/BHMA A156.16 2002 Auxiliary Hardware
ANSI/BHMA A156.18-2006 Materials and Finishes
ANSI/BHMA A156.19-2007 Power-Assist and Low Energy Power Operated Doors
ANSI/BHMA A156.21-2006 Thresholds
ANSI/BHMA A156.26-2006 Continuous Hinges
ANSI/BHMA-A156.28-2007 Recommended Practices for Keying Systems
ANSI/BHMA A156.31-2007 Electric Strikes and Frame Mounted Actuators
ANSI/BHMA A115.1-1990 for Standard Steel Door and Steel Frame Preparations for Mortise Locks
ANSI A117.1 – American National Standards Institute – Accessible and Usable Buildings and Facilities.

- B. NFPA – National Fire Protection Association:
 - 1. NFPA 80 – 1999 – Standard for Fire Doors and Fire Windows
 - 2. NFPA 101 – 2003 – Life Safety Code
 - 3. NFPA 105 – 2003 – Installation of Smoke-Control Door Assemblies
- C. DHI – Door and Hardware Institute:
 - 1. 1989 – Recommended locations
 - 2. 1983 - Abbreviations and symbols.
 - 3. 1996 - Sequence and format for the hardware schedule.
 - 4. 1989 - Recommended procedure for processing hardware schedules and templates.
 - 5. 1989 - Keying systems and nomenclature.
- D. ADA – The American Disabilities Act – Title III – Public Accommodations.
- E. WH – Warnock Hersey, “Certification Listing”

1.04 SUBMITTALS

- A. Product Data: Manufacturer’s illustrated product literature and specifications for each item of hardware.
- B. Hardware Schedule: Submit for review, within 21 days of award of contract, 6 copies of a complete, properly itemized schedule of Builders Finish Hardware to be furnished under this Contract. Clearly refer to each item using manufacturer’s code letters and numbers. Use same set numbers used on door schedule on Drawings. Identify lockset functions. List the actual product series numbers.
 - 1. Schedule for hardware shall be in vertical format.
- C. Samples: If requested, submit to the Architect for approval, a complete line of samples as directed. Samples shall be plainly marked giving hardware number used in this specification, the manufacturer’s numbers, types and sizes. The Architect will deliver approved samples to the project site to be stored. Samples will remain with the Architect until delivery of all hardware to the

project is complete, after which time they will be turned over to the Contractor for incorporation into the work.

- D. Key Schedule: After a keying meeting between representatives of the Owner, Architect, and the Hardware Supplier, provide a keying schedule, listing the levels of keying, as well as an explanation of the key system's function, the key symbols used, and the door numbers controlled. This schedule can be submitted as a part of the Hardware Schedule or as a separate schedule.
- E. Templates: Hardware supplier shall immediately, but not later than thirty (30) days after approval of his Schedule by the Architect, furnish the Contractor with complete template information necessary for the fabrication of doors and frames. No templates shall be furnished prior to the approval of the hardware schedule.
- F. Operations and Maintenance Manuals
 - 1. At the end of the project the hardware supplier shall submit, as a part of the close out package, a three ring binder containing the following information:
 - a. Maintenance instructions for each item of hardware.
 - b. Catalog pages of each product.
 - c. Name, address, phone and fax numbers of the finish hardware distributor.
 - d. Parts list for each major hardware item.
 - e. Copy of the approved hardware schedule.
 - f. Copy of the approved keying schedule.

1.05 QUALITY ASSURANCE

- A. Hardware supplier shall be, or have in his employ, a certified Architectural Hardware Consultant, who is registered in the continuing education program as administered by the Door and Hardware Institute. This Consultant shall review the schedule prior to submittal and affix his or her seal attesting to the completeness and correctness of the schedule and to certify that the work of this section meets or exceeds the requirements of authorities having jurisdiction.
- B. U.L. Listing: Whether specifically mentioned or not, equip fire-rated doors with UL approved hardware of corresponding rating and bearing the proper UL listing mark.
- C. Responsibility for Sizing Hardware: Hardware supplier shall determine conditions and materials of doors and frames for proper application of hardware. Follow manufacturers' catalogue requirement for the actual size of door closers, brackets and holders. Door sizes are as noted on the Door Schedule and the hardware shall be in strict accordance with requirements of height, width, and thickness.
- D. All items of hardware are referenced by manufacturer's names and numbers. The manufacturer's names and numbers are used to define the function, design, and quality of the material to be supplied. Substitution of products other than those listed shall be in accordance with Section 01 2500 Substitution Procedures.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Require the Hardware Supplier to deliver hardware to the project site in accordance with the instructions of the Contractor.

- B. Contractor shall prepare a locked storage room with adequate shelving, for hardware. The storage room shall be in a dry, secure area, and shall not include storage of other products by other trades.
- C. The Contractor shall furnish the Hardware Supplier with receipts for hardware and accessory items received, and shall send copies of these receipts to the Architect, if requested.

1.07 WARRANTY

- A. Hardware supplier shall warrant and guarantee, in writing, that hardware supplied is free of defective material and workmanship. Supplier shall further warrant and guarantee for a period of one year from Owner's Use and Occupancy that the hardware shall function in a satisfactory manner without binding, collapse, or dislodging of its parts, provided the installation is made to the manufacturer's recommendations.

1.08 REGULATORY REQUIREMENTS

- A. Conform to all applicable codes. Provide throws, projections, coatings, knurling, opening and closing forces, and other special functions required by all State of New Hampshire and Local Building Codes, and all applicable Access Code requirements, including ADA.
- B. For fire rated openings provide hardware complying with NFPA 80 and NFPA 101. Provide hardware tested by UL for the type and size of door installed and fire resistance rating required.

1.09 COORDINATION

- A. Hardware Supplier shall determine conditions and materials of doors and frames for proper application of hardware.

1.10 MAINTENANCE MATERIALS AND TOOLS

- A. Extra materials: The following is a list of "Extra" stock that is to be furnished direct to the owner for future maintenance purposes:

	<u>Item</u>	<u>Quantity</u>
1.	Door Closers – type 281-CPSH	3
2.	Door Closers – type 281-0	3
3.	Door Closers – type 281-P10	3
4.	Locksets – Function (A)	1
5.	Locksets – Function (C)	1
6.	Locksets – Function (D)	1

- B. Provide adjusting tools and wrenches for the following operating products:
 - 1.Locksets (all types)
 - 2.Exit Devices (all Types)
 - 3.Door Closers

PART 2 --PRODUCTS

2.01.1 MANUFACTURERS

- A. Subject to compliance with requirements, furnish products by the following manufacturers; furnish all hardware of each type from a single manufacturer.

Hinges	McKinney Hager Ives	Scranton, PA St. Louis, MO Indianapolis, IN
Continuous Hinges	Pemko McKinney ABH	Memphis, TN Scranton, PA Itasca, IL
Locksets	Sargent Schlage Best	New Haven, CT Colorado Springs, CO Indianapolis, IN
Exit Devices / Key Removable Mullions	Sargent Von Duprin Precision	New Haven, CT Indianapolis, IN Indianapolis, IN
Power Supplies (for exit devices)	Sargent Von Duprin Precision	New Haven, CT Indianapolis, IN Indianapolis, IN
Door Closers	Sargent LCN Norton	New Haven, CT Princeton, IL Charlotte, NC
Overhead Stops	Sargent Glynn Johnson ABH	New Haven, CT Indianapolis, IN Itasca, IL
Flush Bolts, Coordinators	Ives Trimco Rockwood	Indianapolis, IN Los Angeles, CA Rockwood, PA
Magnetic Door Holders	ABH Rixson LCN	Itasca, IL Charlotte, NC Princeton, IL
Door Stops	Trimco Ives Rockwood	Los Angeles, CA Indianapolis, IN Rockwood, PA
Push / Pulls	Rockwood Trimco Ives	Rockwood, PA Los Angeles, CA Indianapolis, IN
Protective Plates	Rockwood Trimco Ives	Rockwood, PA Los Angeles, CA Indianapolis, IN
Thresholds, Door Sweeps,	NGP	Memphis, TN

Rain Drips	Pemko Reese	Memphis, TN Rosemount, MN
Silencers	Ives Rockwood Hager	Indianapolis, IN Rockwood, PA St. Louis, MO
Key Cabinet	Telkee MMF Industries Lund	Glen Riddle, PA Wheeling, IL Bath, OH

2.02 MATERIALS AND QUALITY

- A. Hardware shall be of the best grade of solid metal entirely free from imperfections in manufacture and finish.
- B. Qualities, weights, and sizes specified in this Section are the minimum that will be accepted. It is the responsibility of the Hardware Supplier to supply the specified size and weight of hardware and the proper function of hardware in each case and to provide UL approved hardware at all fire-rated doors.
- C. Provide, as far as possible, locks of one lock manufacturer and hinges of one hinge manufacturer. Modifications to hardware that are necessary to conform to construction shown or specified shall be provided as required for the specified operation and functional features.
- D. Follow manufacturers' catalog requirements for the actual size of door closers, brackets and holders.

2.03 HARDWARE FOR LABELED FIRE DOORS, EXIT DEVICES AND SMOKE DOORS

- A. Hardware shall conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other exit doors, as well as to other requirements specified. Labeling and listing by UL Building Materials Directory, for class of door being used will be accepted as evidence of conformance to these requirements. Install minimum latch throw as specified on label of individual doors. Provide hardware listed by UL except where heavier materials, larger sizes, or better grades are specified herein under paragraph titled "Hardware Sets". In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements. Specific hardware requirements of door or frame manufacturers which exceed sizes or weights of hardware listed in this Section shall be provided with no additional charge.

2.04 FASTENERS

- A. Manufacture hardware to conform to published templates, generally prepared for machine screw installation.
- B. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish exposed screws to match the hardware finish, or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.

- C. Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent no standard manufactured units of the type specified are available with concealed fasteners. Do not use thru-bolts unless specifically approved by the Architect.
- D. Use only the fasteners supplied by manufacturers of specific products.
- E. Hardware shall have the required screws, bolts and fastenings necessary for proper installation and shall be wrapped in the same package as the hardware item for which it was intended.

2.05 PACKING AND MARKING

- A. Clearly label each package to indicate the portion of the work for which it is intended.

2.06 ENVIRONMENTAL CONCERN FOR PACKAGING

- A. The hardware shipped to the jobsite is to be packaged in biodegradable packs such as paper or cardboard boxes and wrapping. If non-biodegradable packing such as plastic, plastic bags or large amounts of Styrofoam is utilized, then the Contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the non-biodegradable packing.

2.07 FINISH HARDWARE DESCRIPTION

- A. Hardware items shall conform to respective specifications and standards and to requirements specified herein.
- B. Continuous Geared Hinges: Hinges on exterior and interior doors where scheduled, shall be full-mortise Continuous Geared Hinges. Geared Hinges shall be manufactured of extruded 6063-T6 aluminum alloy temper. Hinges shall consist of three interlocking extrusions in a pinless assembly applied to the full height of the door and frame. All hinges shall be manufactured non-handed. Door leaf and jamb leaf shall be geared together for the entire length of the hinge and joined by a cover channel. All Geared Hinges shall be heavy duty (HD).

- 1. Manufacturer and Product: Pemko, McKinney or ABH as follows:
 - a. Pemko FMSLFHD
 - b. McKinney MCK-12HD
 - c. ABH A110HD

C. Butt Hinges:

- 1. Number of hinges per door: Provide two hinges for doors up to and including five feet in height, and an additional hinge for each two-and-one-half feet or fraction thereof, of the height of the door. Dutch doors are to be provided with four hinges.
- 2. Hinges on interior doors shall be concealed bearings, steel and sized as follows, unless otherwise specified in the hardware sets below:

<u>Door thickness</u>	<u>Door width</u>	<u>Hinge Weight</u>	<u>Hinge</u>
1-3/4"	40" and under	Regular	4-1/2 x 4
1-3/4"	Over 40"	Extra heavy	5 x 4-1/2

Width of hinge shall be determined by trim conditions

3. All hinges to be of 3 knuckle construction, with a button tip and pin with a hole in the bottom tip for easy pin removal. Bearing hinges shall have flush bearings and button tips. Plain bearing hinges shall be furnished only on doors so noted in Hardware Sets.
4. Manufacturer: Hinges shall be McKinney, Hager or Ives as follows:

<u>McKinney</u>	<u>Hager</u>	<u>Ives</u>
TA714	AB700	3CB1
TA786	AB750	3CB1HW

D. Door Closers:

1. Door closers shall have full rack and pinion construction.
2. Hydraulic fluid shall be of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and hydraulic back-check.
4. All arms shall be finely finished with heavy duty forged steel main arms (and forged forearms for parallel arm closers).
5. Closer arms (and metal covers when specified) shall have a powder coating finish.
6. Provide drop, mounting plates where required.
7. Closers should comply with UL 10C and UBC 7-2 (1997) Positive Pressure Fire Test.
8. Do not locate closers on the side of doors facing corridors, passageways or similar type areas. Where it is necessary, due to certain conditions and approval of the Architect, to have closers in corridors, provide such closers with parallel or track type arms.
9. Adjust door closers in accordance with the manufacturer's templates and written instructions. Adjust back-check feature on closers with parallel arms prior to installation.
10. Closers shall conform to applicable code requirements relative to setting closing speeds for closers and maximum pressure for operating interior and exterior doors.
11. Door closers meeting this specification are as follows:

	<u>LCN</u>	<u>Sargent</u>	<u>Norton</u>
<u>Exterior</u>	4111S-CUSH 4111S-H-CUSH	281-CPS 281-CPSH	CPS7500 CPS7500T
<u>Interior</u>	4011 (Reg. arm) 4111 (Par. Arm) 4000T (Pocket Type)	281-O 281-P10 281-OT x spec. temp.	7500 PR7500 7700STP

E. Exit Devices:

1. Shall be Von Duprin, Sargent or Precision as follows:

<u>Function</u>	<u>Von Duprin</u>	<u>Sargent</u>	<u>Precision</u>
A	E9947L-F x LBR	12-NBMD8673ET	E-FL-2803LBR x 4908
B	99L-F-BE	12-8815ET	FL-2114 x 4914
C	99L-NL-F x KOSL	12-76-8804ET	FL-2103 x 4903 KNR
D	9927L-F x LBR	12-NB8713ET	FL-2208 x 4908 x LBR
E	9927L x LBR	NB-8713ET	2208 x 4908 x LBR
F	99EO	8810	2101
G	RXQEL99NL-OP	55-56-8804 x less trim	TS-ELR-2103 x No. 3
H	CD99NL-OP	16-8804 x less trim	2103CD
I	CD99EO	16-8810	2101CD
J	99NL-OP	8804 x less trim	2103

Note: Lever design shall match lock trim.

The Sargent exit devices are to be furnished with the pre-fix "43" (flush end cap).

F. Power Transfer: Provides a means to transfer power from the frame to the door stile. When the door is closed the unit is concealed and tamper resistant. Securitron EPT or EPTL, Von Duprin EPT-2 or EPT-10, ABH PT200EZ or PT1000EZ.

G. Power Supplies: Provide power supplies for use with electrified exit devices: one of the following: Von Duprin PS902-2Q, PS902-FA (as required), Sargent 3520 or 3540, or Precision ELR151 or ELR152.

H. Key Removable Mullion: Shall be Von Duprin KR 4954, Sargent L980S, or Precision KR 822 at non-fire rated openings. All mullions are to be furnished complete with mullion stabilizers.

I. Electro-Magnetic Door Holders: Surface mounted wall magnetic units; one of the following:

<u>Manufacturer</u>	<u>Product</u>
ABH	2100Series
Rixson	FM-998
LCN	SEM 7850

Note: Provide solid armature extension pieces, not a chain, where required, similar to ABH S20020 series extensions.

J. Flush Bolts: Self-Latching or automatic type at label doors, manual flush bolts at non-label doors. Furnish dust proof strikes at all floor locations.

		<u>Ives</u>	<u>Trimco</u>	<u>Rockwood</u>
Manual	HM	FB458	3917-12"	555
	WD	FB458	3917-12"	555
Self-Latching	HM	FB51P	3820 x 3810	1845
	WD	FB61P	3825 x 3815	1945

K. Automatic Coordinating: Shall be provided at all pairs of label doors equipped with overlapping astragals or where improper closing sequence would interfere with proper operating of the doors. Coordinators shall be Ives COR series, Trimco 3094 series or Rockwood 1600 series. Furnish filler pieces to close opening between coordinator and jamb of frame. Provide mounting brackets as required for proper mounting of additional hardware.

- L. Lock Sets, Latch Sets: Mortise type shall be heavy-duty ANSI A156.13, Series 1000, Grade 1 operational, 2-3/4" backset, six pin inter-changeable core cylinder with lever handles. Strikes are to have curved lips and complete with a wrought box.

1. Manufacturer and products:

<u>Manufacturer</u>	<u>Series</u>	<u>Lever Design</u>
Schlage	L9000	06A
Sargent	8200	LNL
Best	40H	15H

2. Lock functions as indicated in the hardware schedule shall be as follows:

<u>Function</u>	<u>Schlage</u>	<u>Sargent</u>	<u>Best</u>
A (Spec. Classroom)	71	38	INL
B (Latchset)	10	15	N
C (Storeroom)	80	04	D x Tactile Warning O/S lever
D (Privacy)	40	65	L
E (Office)	50	05	A
F (Storeroom)	80	04	D
G (Classroom)	70	37	R
H (Vestibule)	60	16	C

- M. Mortise Deadlocks: ANSI A115.5, Grade 1.

<u>Function</u>	<u>Schlage</u>	<u>Sargent</u>	<u>Best</u>
A (Classroom)	L463	4877	48H-R

- N. Electric Strikes: Heavy-duty, fire rated, stainless steel strikes meeting BHMA 501 for grade 1 and ANSI/BHMA A156.5-1992; U.L. listed; fail secure (unlocked when energized), rated for continuous duty operation.

1. Acceptable Product: Hanchett Entry Systems, Inc. (HES), 1006 Series electric strikes with Model 2005M3 - SMART Pac III Power Controller.
2. Power Supply: Furnish a Multi-Output, class 2 regulated power supply – Securitron BPS Series.

- O. Push Plates, Door Pulls, Push / Pull Bar Sets:

1. Manufacturer: Rockwood, Trimco or Ives.
2. Push Plates: 8" x 16", stile permitting, or 4" x 16" for narrow stile x .050 thickness:
 - a. Rockwood 70 Series
 - b. Trimco 1001 Series
 - c. Ives 8200 Series
3. Door Pulls, Type A:
 - a. Rockwood BF111
 - b. Trimco 1195-2
 - c. Ives 8103EZ-0
4. Door Pulls, Type B x Modified to have 7" CTC:

- a. Rockwood 157
- b. Trimco 1191-3
- c. Ives 8190

6. Push / Pull Bar Sets:

- a. Rockwood 15747 x T4HD fastening
- b. Trimco 1737JG x sim. fastening
- c. Ives 9190-0 x sim. fastening

P. Kick Plates, Armor Plates: .050 inch thick, beveled 4 edges, furnish with oval head counter-sunk screws for fastening; widths 2 in. less the width of door; as follows:

- 1. Kick Plates: 8 in. high.
- 2. Armor Plates: 34 in. high.

Q. Stops: Furnish at all doors. Wherever an opened door or any item of hardware thereon strikes a wall, at 90 degrees, provide wall bumpers, unless otherwise indicated in hardware sets.

1. Where wall bumpers cannot be effectively used, a floor stop shall be furnished and installed.

2. Provide roller bumpers for each door where two doors interfere with each other in swinging.

<u>Manufacturer</u>	<u>Wall Bumpers</u>	<u>Floor Stops</u>	<u>Roller Bumpers</u>
Rockwood	409	440, 442	456
Ives	WS407CCV	FS436, FS438	RB470 Series
Trimco	1270WV	1211	1244

3. Where door stops / holders are listed they shall be heavy duty, wall mounted type as follows:

<u>Manufacturer</u>	<u>Product Number</u>
Rockwood	494
Ives	FS495
Hager	326W

4. Where overhead stops are listed they shall be the surface mounted type as follows:

<u>Manufacturer</u>	<u>Series</u>
Glynn-Johnson	450S
Sargent	1540S
ABH	4420

5. Where overhead concealed door stops are listed they shall be as follows:

<u>Manufacturer</u>	<u>Series</u>
Glynn-Johnson	100SA
Sargent	690S
ABH	1020

R. Thresholds, Weather-Strips, Seals:

1. Thresholds: Extruded aluminum; furnish at all doors indicated. Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants".
2. Weatherstripping: furnish on all exterior doors.
3. Products:

<u>Item</u>	<u>Pemko</u>	<u>Reese</u>	<u>NGP</u>
Threshold	-----	as detailed	-----
Door Sweep	345AV	353A	101VA - type A
Door Sweep	307A	806A	97VA – type B
Rain Drip	346C	R201C	16A

- S. Self Adhesive Door Astragal Seal: #SA as manufactured by Door and Hardware Systems, Inc. (color as selected).
- T. Gasketing: #105 "Cush-N-Seal" as manufactured by Door and Hardware Systems, Inc., (color as selected).
- U. Mullion Seal: #MS-SA-75 as manufactured by Door and Hardware Systems, Inc. (color as selected). This seal is to be installed to the mullion prior to the mullion being installed at the opening.
- V. Adjustable Mortise Door Bottom: #AMDB3-3 SWE (wood doors) or #AMDB3-3 x CC (hollow metal doors) as manufactured by Door and Hardware Systems, Inc.
- W. Surface Door Bottom: #SSDB3 as manufactured by Door and Hardware Systems, Inc.
- X. Weatherstripping: #105 CNS-3HJ as manufactured by Door and Hardware Systems, Inc., (color as selected).
- Y. Fire Department Key Keepers:
 1. Unit for recessed in wall construction, with heavy 1/8" stainless steel lock cover, 1/2" solid steel plate door with weather resistant silicone door gasket. Exterior dimensions; 8 1/2" H x 8 1/2" W x 4 1/2" deep. U.L. listed box and lock. Knox Company "Model 4100 Knox-Vault", complete with Recessed Mounting Kit (RMK).
 - a. Knox-Coat finish: interior and exterior of box; black color.
 - b. Ensures high security with UL Medeco lock (s).
 - c. Dust Cover: 1/8" thick stainless steel dust cover.
 2. Quantity: Furnish Two (2). Locate as directed by the architect.
- Z. Silencers: Provide silencers on all metal and wood frames. Silencers shall be Ives SR64 / SR65, Hager 307D / 308D or Rockwood 608 / 609.

2.08 . FINISHES

A. Materials and finish: Materials and finishes shall be:

1. Interior Butts: US26D (BHMA 652)
2. Geared Hinges: US28 (BMHA 628)
3. Door Closers: Powder coat finish to match hardware finish
4. Exit Devices: US26D (BHMA 626)
5. Kick, Push Plates, Door Pulls, Push / Pull Bars: US32D (BHMA 630)
6. All other hardware shall be: US26D (BHMA 626), or as scheduled.

2.09 KEYS AND KEYING

A. The hardware supplier shall review the specific hardware functions with the Architect and owner at the time of the keying review, to assure the appropriateness of each of the hardware functions. Failure to make this review does not relieve the hardware supplier from providing the proper functions.

B. Key System: Cylinders shall be Masterkeyed and/or Grandmasterkeyed to a new system for this building.

1. Key Quantity:

1. Furnish four (4) change keys for each cylinder keyed differently; six (6) change keys for each set keyed alike, and in sets where only (2) cylinders are keyed alike, four (4) change keys will be required.
 2. Master Keys: Furnish three (3) keys for each set.
 3. Grandmaster Keys: Furnish two (2) keys for each grandmaster system.
 4. One extra key blank for each lock.
 5. Construction Keys: Furnish four (4).
2. Cylinders are to be of the interchangeable core type. These cylinders are to be furnished complete with temporary removable construction cores for use by the contractor during the construction period. The construction cores remain property of the supplier and shall be returned to the supplier when they are removed. Contractor shall install the permanent cores in the presence of the Owner's representative. Furnish three (3) control keys each for the removal of the construction cores and the installation of the permanent cores.
3. Permanently inscribe each key and cylinder with Visual Key Control that identifies cylinder manufacturer key symbol, and inscribe key with the notation "DO NOT DUPLICATE".
4. Provide keys of nickel silver only.
5. Keying is to be done at the factory to avoid duplication of the new cylinders.
6. Master Keys shall be sent to the Owner by registered mail, return receipt required.
7. Supply a bitting list for all change keys and master keys to the owner.

2.10. Key Cabinet:

1. Furnish two (2) "Dupli-Key" Two Tag wall cabinets as manufactured by MMF Industries, or equal wall cabinet by Lund or Telkee, Inc. Furnish hooks, file tags, duplicate tags, key collection envelopes, key receipt holders / slips and complete 3 way cross index binder to provide a complete Dual Key Tag System.

2. Cabinet size shall be sufficient to accommodate all locks related to this Contract, based on two keys per lock, with an allowance for expansion of not less than 50%.
3. Key systems which are construction keyed shall have all permanent keys affixed to hooks with all index cards filled out for the complete cross references. The cabinet shall be delivered to the Contractor, only when requested, and shall be completely set up.

PART 3--EXECUTION

3.01. INSPECTION

- A. Inspect door openings and doors to determine that each door and door frame has been properly prepared for the required hardware. If errors in dimensions or preparation are encountered, they are to be corrected by the responsible parties prior to the installation of hardware.

3.02 PREPARATION

- A. Doors and frames, requiring field preparation for finish hardware, shall be carefully mortised, drilled for pilot holes, or tapped for machine screws for all items of finish hardware in accordance with the manufacturer's templates and instructions.

3.03 INSTALLATION/ADJUSTMENT/LOCATION

- A. Install materials in a workmanlike manner following the manufacturer's recommended instructions.
- B. Install Exit Devices carefully to permit friction free operation of crossbar, touch bar, lever. Latching mechanism shall also operate freely without friction or binding.
- C. Install Door Closers in accordance with the manufacturer's instructions. Each door closer shall be carefully installed, on each door, at the degree of opening indicated on the hardware schedule. Arm position shall be as shown on the instruction sheets and required by the finish hardware schedule.
- D. The adjustments for door closers shall be the installers responsibility and these adjustments shall be made at the time of installation of the door closer. The closing speed and the latching speed valves shall be adjusted individually to provide a smooth, continuous closing action without slamming. The delayed action feature or back check valve shall also be adjusted so as to permit the correct delayed action cycle or hydraulic back check cushioning of the door in the opening cycle. All valves must be properly adjusted at the time of installation. Each door closer has adjustable spring power capable of being adjusted, in the field, from size 2 thru 6. It shall be the installers responsibility to adjust the spring power for each door closer in exact accordance with the spring power adjustment chart illustrated in the door closer installation sheet packed with each door closer.
- E. Installation of all other hardware, including locksets, overhead holders, door stops, plates and other items, shall be carefully coordinated with the hardware schedule and the manufacturer's instruction sheets.

3.04 FIELD QUALITY CONTROL

- A. Upon completion of the installation of the finish hardware, a representative of the finish hardware supplier is to visit the project and to examine the hardware for each door on which he or she has provided hardware and to verify that all hardware is in proper working order. Should items of hardware not operate properly, make a report, in writing, to the Contractor, advising the Contractor of the problem and the measures required to correct the problem.

3.05 PROTECTION

- A. Carefully protect exposed surfaces of finish hardware, by use of cloth, adhesive backed paper or other materials, immediately after installation of the hardware item on the door. The finish shall remain protected until completion of the project. Just prior to the inspection at the time of Substantial Completion, remove the protective material.

3.06 CLEANING

- A. Clean finish hardware and remove remaining pieces of protective materials and labels.

3.07 HARDWARE SETS

- A. Each Hardware Set listed below represents the complete hardware requirements for one opening (single door or pair of doors). Furnish the quantities required for each set for the work.

Set No. EX1

- 2 – Continuous Hinges
- 2 – Exit Devices (Function F-exit only)
- 2 – Mullion Stabilizers
- 1 – Key Removable Mullion
- 1 – Mullion Seal
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 2 – Door Closers – H-CUSH
- 2 – Kick Plates
- 1 – Threshold – as detailed
- 2 – Door Sweeps – type A
- 1 – Rain Drip
- 1 – Set Weatherstripping (H, J)
- 2 – Door Contacts – Furnished, installed by security contractor.

Set No. EX2

- 1 – Continuous Hinge
- 1 – Continuous Hinge x prep for EPT
- 1 – Power Transfer – EPT-10
- 1 – Exit Device (Function G)
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 1 – Power Supply
- 1 – Exit Device (Function F)
- 2 – Mullion Stabilizers
- 1 – Key Removable Mullion

- 1 – Mullion Seal
 - 1 – I/C Cylinder
 - 1 – Cylinder Core
 - 2 – Door Pulls – type B
 - 2 – Door Closers – H-CUSH
 - 2 – Overhead Concealed Door Stops
 - 1 – Threshold – as detailed
 - 2 – Door Sweeps
 - 1 – Rain Drip
 - 1 – Set Weatherstripping – door manufacturer's standard
 - 1 – Set Astragals – door manufacturer's standard
 - 2 – Door Contacts – Furnished, installed by security contractor
- Note: Card reader – furnished, installed by security contractor.
Operation: Immediate egress always allowed. Access by key, or by the card reader on the active leaf. Card reader will retract the exit device latchbolt on the active leaf and allow access.

Set No. EX3

- 1 – Continuous Hinge
- 1 – Lockset (Function H-vestibule)
- 2 – Cylinder Cores
- 1 – Door Closer (Reg. arm)
- 1 – Kick Plate
- 1 – Threshold – as detailed
- 1 – Door Sweep – type B
- 1 – Set Weatherstripping (H, J)

Set No. EX4

- 1 – Continuous Hinge
- 1 – Continuous Hinge x prep for EPT
- 1 – Power Transfer – EPT-10
- 1 – Exit Device (Function G)
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 1 – Power Supply
- 1 – Exit Device (Function F)
- 2 – Mullion Stabilizers
- 1 – Key Removable Mullion
- 1 – Mullion Seal
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 2 – Door Pulls – type B
- 1 – Door Closer – H-CUSH
- 1 – Mounting Plate – if required
- 1 – Power-Assist Door Operator – LCN No. 4640 Series (Flush ceiling mounted)
- 2 – Push Plate Actuators – LCN No. 8310-853T/8310-818T as required
- 1 – Pushbutton Mini Box – Von Duprin No. 660 Series
- 2 – Overhead Concealed Door Stops
- 1 – Threshold – as detailed
- 2 – Door Sweeps – type A
- 1 – Rain Drip

1 – Set Weatherstripping – (H, J)
2 – Door Contacts – Furnished, installed by security contractor.
Note: Card reader – furnished, installed by security contractor.
Operation: Immediate egress always allowed. Door can be manually or automatically operated. Access control system to retract and hold exit device latchbolt and enable exterior automatic operator actuator wall plate switch. Door can be manually pulled open or automatically operated by pushing wall plate which signals automatic operator to open door. Interior wall plate switch to signal automatic operator to open door. Locate wall plate actuators as directed by the architect. Secure operation: Access by key, card reader, or buzzer system. Card reader or buzzer system will retract the exit device latchbolt and allow access, and temporarily enable exterior wall plate actuator to allow automatic operation.

Set No. EX5

2 – Continuous Hinges
1 – Exit Device (Function H)
2 – I/C Cylinders (1/ for device-1/ for CD feature)
2 – Cylinder Cores
1 – Exit Device (Function I)
1 – I/C Cylinder (for CD feature)
2 – Mullion Stabilizers
1 – Key Removable Mullion
1 – Mullion Seal
1 – I/C Cylinder
1 – Cylinder Core
2 – Door Pulls – type B
2 – Door Closers – H-CUSH
2 – Overhead Concealed Door Stops
1 – Threshold – as detailed
2 – Door Sweeps-type A
1 – Rain Drip
1 – Set Weatherstripping (H, J)
2 – Door Contacts – Furnished, installed by security contractor

Set No. EX5A

1 – Continuous Hinge
1 – Exit Device (Function J)
1 – I/C Cylinder
1 – Cylinder Core
1 – Door Pull – type B
1 – Door Closer – H-CUSH
1 – Mounting Plate – if required
1 – Kick Plate
1 – Threshold – as detailed
1 – Door Sweep – type A
1 – Rain Drip
1 – Set Weatherstripping (H, J)

Set No. EX6

1 – Continuous Hinge

- 1 – Exit Device (Function F-exit only)
- 1 – Door Closer – H-CUSH
- 1 – Kick Plate
- 1 – Threshold – as detailed
- 1 – Door Sweep – type A
- 1 – Rain Drip
- 1 – Set Weatherstripping (H, J)

Set No. EXAL1

- 1 – Continuous Hinge
 - 1 – Continuous Hinge x prep for EPT
 - 1 – Power Transfer – EPT-10
 - 1 – Exit Device (Function G)
 - 1 – I/C Cylinder
 - 1 – Cylinder Core
 - 1 – Power Supply
 - 1 – Exit Device (Function F)
 - 2 – Mullion Stabilizers
 - 1 – Key Removable Mullion
 - 1 – Mullion Seal
 - 1 – I/C Cylinder
 - 1 – Cylinder Core
 - 2 – Door Pulls – type B
 - 2 – Door Closers – H-CUSH
 - 2 – Overhead Concealed Door Stops
 - 1 – Threshold – as detailed
 - 2 – Door Sweeps – type A
 - 1 – Set Weatherstripping – door manufacturer's standard
 - 1 – Set Astragals – door manufacturer's standard
 - 2 – Door Contacts – Furnished, installed by security contractor
- Note: Card reader – furnished, installed by security contractor.
Operation: Immediate egress always allowed. Access by key, or by the card reader on the active leaf. Card reader will retract the exit device latchbolt on the active leaf and allow access.

Set No. EXAL2

- 1 – Continuous Hinge
- 1 – Continuous Hinge x prep for EPT
- 1 – Power Transfer – EPT-10
- 1 – Exit Device (Function G)
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 1 – Power Supply
- 1 – Exit Device (Function F)
- 2 – Mullion Stabilizers
- 1 – Key Removable Mullion
- 1 – Mullion Seal
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 2 – Door Pulls – type B
- 1 – Door Closer – H-CUSH

- 1 – Mounting Plate – if required
- 1 – Power-Assist Door Operator – LCN No. 4640 Series (Flush ceiling mounted)
- 2 – Push Plate Actuators – LCN No. 8310-853T/8310-818T as required
- 1 – Pushbutton Mini Box – Von Duprin No. 660 Series
- 2 – Overhead Concealed Door Stops
- 1 – Threshold – as detailed
- 2 – Door Sweeps – type A
- 1 – Set Weatherstripping – door manufacturer's standard
- 1 – Set Astragals – door manufacturer's standard
- 2 – Door Contacts – Furnished, installed by security contractor.

Note: Card reader – furnished, installed by security contractor.

Operation: Immediate egress always allowed. Door can be manually or automatically operated. Access control system to retract and hold exit device latchbolt and enable exterior automatic operator actuator wall plate switch. Door can be manually pulled open or automatically operated by pushing wall plate which signals automatic operator to open door. Interior wall plate switch to signal automatic operator to open door. Locate wall plate actuators as directed by the architect. Secure operation: Access by key, card reader, or buzzer system. Card reader or buzzer system will retract the exit device latchbolt and allow access, and temporarily enable exterior wall plate actuator to allow automatic operation.

Set No. AL1

- 2 – Continuous Hinges
- 2 – Sets Push / Pull Bars
- 2 – Door Stops
- 1 – Door Closer (Par. Arm)
- 1 – Mounting Plate – if required
- 1 – Power-Assist Door Operator – LCN No. 4640 Series (Flush ceiling mounted)
- 2 – Kick Plates

Set No. 1

Butts

- 1 – Lockset (Function A-special classroom)
- 2 – Cylinder Cores
- 1 – Door Stop
- 3 – Silencers

Set No. 1A

Butts

- 1 – Lockset (Function A-special classroom)
- 2 – Cylinder Cores
- 1 – Door Stop
- 1 – Adjustable Mortise Door Bottom
- 1 – Set Gasketing (H, J)

Set No. 2

Butts

- 1 – Latchset (Function B)
- 1 – Door Stop

- 1 – Adjustable Mortise Door Bottom
- 1 – Set Gasketing (H, J)

Set No. 3

Butts

- 1 – Lockset (Function G-classroom)
- 1 – Cylinder Core
- 1 – Door Stop
- 3 – Silencers

Set No. 4

Butts

- 1 – Lockset (Function A-special classroom)
- 2 – Cylinder Cores
- 1 – Door Stop
- 1 – Door Closer (Reg. arm)
- 1 – Kick Plate
- 3 – Silencers

Set No. 5

Butts

- 1 – Lockset (Function G-classroom)
- 1 – Cylinder Core
- 1 – Door Stop
- 1 – Adjustable Mortise Door Bottom
- 1 – Set Gasketing (H, J)

Set No. 6

Butts

- 1 – Privacy Set (Function D)
- 1 – Door Stop
- 1 – Set Gasketing (H, J)

Set No. 6A

Butts

- 1 – Privacy Set (Function D)
- 1 – Electric Strike – type A
- 1 – Power Supply
- 1 – Door Stop
- 1 – Power-Assist Door Operator – LCN 4640 Series (Flush ceiling mount)
- 2 – Push Plate Actuators – LCN No. 8310-853T / 8310-818T (as required)
- 1 – Kick Plate
- 1 – Set Gasketing (h, J)

Set No. 7

- 1 – Continuous Hinge

- 1 – Deadlock (Function A)
- 1 – Cylinder Core
- 1 – Push Plate
- 1 – Door Pull – type A
- 1 – Door Stop
- 1 – Door Closer (Reg. arm)
- 1 – Kick Plate
- 3 - Silencers

Set No. 8

Butts

- 1 – Lockset (Function E-office)
- 1 – Cylinder Core
- 1 – Door Stop
- 3 – Silencers

Set No. 9

Butts

- 1 – Push Button Access Control Lock – Alarm Lock No. DL4100 – US26D x cylinder as required
- 1 – Cylinder Core
- 1 – Door Stop
- 1 – Door Closer (Reg. arm)
- 1 – Kick Plate
- 1 – Set Gasketing (H, J)

Set No. 10

Butts

- 1 – Lockset (Function E-office)
- 1 – Cylinder Core
- 1 – Door Stop
- 1 – Adjustable Mortise Door Bottom
- 1 – Set Gasketing (H, J)

Set No. 11

Butts

- 1 – Lockset (Function G-classroom)
- 1 – Cylinder Core
- 2 – Manual Flush Bolts
- 1 – Dust Proof Strike
- 2 – Overhead Stops
- 2 - Silencers

Set No. 12

Butts

- 1 – Lockset (Function A-special classroom)
- 2 – Cylinder Cores
- 2 – Manual Flush Bolts

- 1 – Dust Proof Strike
- 3 – Silencers

Set No. 13

Butts

- 1 – Lockset (Function C-storeroom) x tactile warning on o/s lever
- 1 – Cylinder Core
- 1 – Door Stop
- 1 – Door Closer (Par. Arm)
- 1 – Kick Plate
- 3 – Silencers

Set No. 14

- 2 – Continuous Hinges
- 2 – Push Plates
- 2 – Door Pulls – type A
- 2 – Door Stops
- 2 – Door Closers (Par. arm)
- 2 – Kick Plates
- 2 – Silencers

Set No. 15

- 2 – Continuous Hinges
- 1 – Deadlock (Function A)
- 1 – Cylinder Core
- 2 – Manual Flush Bolts
- 1 – Dust Proof Strike
- 2 – Push Plates – 1/CFC, 1/CFT
- 2 – Door Pulls – type A
- 2 – Door Stops
- 2 – Door Closers (Reg. arm)
- 2 – Kick Plates
- 2 – Silencers

Set No. 16

- 1 – Continuous Hinge
- 1 – Continuous Hinge x prep for EPT
- 1 – Power Transfer
- 1 – Lockset (Function F-storeroom)
- 1 – Cylinder Core
- 1 – Electric Strike – type A
- 1 – Power Supply
- 2 – Manual Flush Bolts
- 1 – Dust Proof Strike
- 2 – Door Stops
- 2 – Door Closers (Reg. arm)
- 2 – Kick Plates
- 2 – Silencers

Note: Card reader – furnished, installed by security contractor.
Raceway required in the inactive leaf to carry power to the electric strike.

Set No. 17

Butts

- 1 – Lockset (Function F-storeroom)
- 1 – Cylinder Core
- 1 – Electric Strike – type A
- 1 – Power Supply
- 1 – Door Stop
- 1 – Door Closer (Reg. arm)
- 1 – Kick Plate
- 3 – Silencers

Note: Card reader – furnished, installed by security contractor.
Furnish parallel arm door closer at doors B222A, A319A.

Set No. 18

- 2 – Continuous Hinges-UL x prep for EPT
- 2 – Power Transfers
- 2 – Concealed Vertical Rod Exit Devices (Function A)
- 2 – I/C Cylinders
- 2 – Cylinder Cores
- 1 – Power Supply
- 2 – Door Stops
- 2 – Electro-Magnetic Door Holders
- 2 – Door Closers – LCN 4000T Series (wall pocket mount)
- 2 – Kick Plates
- 1 – Self Adhesive Door Astragal Seal
- 1 – Set Gasketing (H, J)

Note: Blocking is required, in the wall behind the door, to allow the door closer body to be installed on the wall. Raceway is required in the door to carry power from the frame to the exit devices.

Operation: Doors can be locked / unlocked from a distant controller as a part of the access control system or a separate key switch. Verify with the architect which will be used. If the doors are in the locked mode you can access the door with the cylinder for night latch function on the stair side of the door. If the doors are secure on the stair side and the building should go into alarm the trim on the stair side is operable. You can always exit the floor by depressing the exit device bar.

Set No. 19

- 2 – Continuous Hinges-UL x prep for EPT
- 2 – Power Transfers
- 2 – Concealed Vertical Rod Exit Devices (Function A)
- 2 – I/C Cylinders
- 2 – Cylinder Cores
- 1 – Power Supply
- 2 – Door Stops
- 2 – Electro-Magnetic Door Holders

- 2 – Door Closers (Par. arm)
- 2 – Kick Plates
- 1 – Self Adhesive Door Astragal Seal
- 1 – Set Gasketing (H, J)

Note: Install the door closers at the alternate mounting location to allow the doors to swing 180 degrees to make contact with the electro-magnetic door holders. Raceway is required in the door to carry power from the frame to the exit devices.

Operation: Doors can be locked / unlocked from a distant controller as a part of the access control system or a separate key switch. Verify with the architect which will be used. If the doors are in the locked mode you can access the door with the cylinder for night latch function on the stair side of the door. If the doors are secure on the stair side and the building should go into alarm the trim on the stair side is operable. You can always exit the floor by depressing the exit device bar.

Set No. 20

- 1 – Continuous Hinge-UL
- 1 – Exit Device (Function B)
- 1 – Door Stop
- 1 – Electro-Magnetic Door Holder
- 1 – Door Closer (Reg. arm)
- 1 – Kick Plate
- 1 – Set Gasketing (H, J)

Set No. 21

All hardware is to be furnished by the overhead door / revolving door supplier.

Set No. 21A

All hardware is to be furnished by the wire mesh door supplier, except as follows:

- 1 – I/C Cylinder (rim or mortise as required)
- 1 – Cylinder Core

Set No. 22

Butts

- 1 – Exit Device (Function C)
- 1 – I/C Cylinder
- 1 – Cylinder Core
- 1 – Door Stop
- 1 – Door Closer (Par. arm)
- 1 – Kick Plate
- 3 – Silencers

Set No. 23

Butts

- 2 – Exit Devices (Function D)
- 2 – I/C Cylinders

- 2 – Cylinder Cores
- 2 – Door Stops
- 2 – Door Closers (Par. Arm)
- 2 – Kick Plates
- 1 – Self Adhesive Door Astragal Seal
- 2 – Adjustable Mortise Door Bottoms
- 1 – Set Gasketing (H, J)

Set No. 24

Butts

- 1 – Lockset (Function C-storeroom) x tactile warning on o/s lever
- 1 – Cylinder Core
- 1 – Door Stop
- 1 – Door Closer (Par. Arm)
- 1 – Kick Plate
- 1 – Adjustable Mortise Door Bottom
- 1 – Set Gasketing (H, J)

Set No. 25

Butts

- 1 – Lockset (Function I-storeroom) x less o/s trim, except cylinder
- 1 – Cylinder Core
- 1 – Flush Pull – Rockwood No. 94C
- 2 – Manual Flush Bolts
- 1 – Dust Proof Strike
- 1 – Door Closer (Par. Arm)
- 1 – Self Adhesive Door Astragal Seal
- 1 – Set Gasketing (H, J)

Note: Door closer is only required on the active leaf.

Set No. 26

- 2 – Continuous Hinges
- 2 – Exit Devices (Function E)
- 2 – I/C Cylinders
- 2 – Cylinder Cores
- 2 – Door Stops
- 2 – Door Closers (Par. Arm)
- 2 – Kick Plates
- 2 – Silencers

Set No. 27

- 2 – Continuous Hinges
- 2 – Sets Push / Pull Bars
- 2 – Door Stops
- 1 – Door Closer (Par. Arm)
- 1 – Mounting Plate – if required
- 1 – Power-Assist Door Operator – LCN No. 4640 Series (Flush ceiling mounted)
- 2 – Kick Plates

2 – Door Silencers

Set No. 28

Butts

2 – Exit Devices (Function E)
2 – I/C Cylinders
2 – Cylinder Cores
2 – Door Stops
2 – Door Closers (Par. arm)
2 – Kick Plates
2 – Silencers

Set No. 29

Butts

1 – Lockset (Function C-storeroom) x tactile warning on o/s lever
1 – Cylinder Core
1 – Set Self Latching Flush Bolts
1 – Dust proof Strike
1 – Door Coordinator x mounting brackets as required
2 – Door Stops
2 – Door Closers (Par. Arm)
2 – Kick Plates
2 – Door Silencers

Set No. 30

Butts

1 – Lockset (Function A-special classroom)
2 – Cylinder Cores
2 – Manual Flush Bolts
1 – Dust Proof Strike
2 – Surface Automatic Door Bottoms
1 – Self Adhesive Door Astragal Seal
1 – Set Gasketing (H, J)

Set No. 31

Butts

1 – Lockset (Function F-storeroom)
1 – Cylinder Core
1 – Electric Strike
1 – Power Supply
1 – Door Stop
1 – Door Closer (Reg. Arm)
1 – Kick Plate
1 – Adjustable Mortise Door Bottom
1 – Set Gasketing (H, J)

Set No. 32

Butts

- 2 – Exit Devices (Function E)
- 2 – I/C Cylinders
- 2 – Cylinder Cores
- 2 – Door Stops
- 2 – Door Closers (Par. arm)
- 2 – Kick Plates
- 2 – Adjustable Mortise Door Bottoms
- 1 – Self Adhesive Door Astragal Seal
- 1 – Set Gasketing (H, J)

Set No. 33

Butts

- 2 – Push Plates
- 2 – Door Pulls – type A
- 2 – Door Stops
- 2 – Door Closers (Reg. arm)
- 2 – Kick Plate
- 1 – Self Adhesive Door Astragal Seal
- 2 – Adjustable Mortise Door Bottoms
- 1 – Set Gasketing (H, J)

Set No. 34

- 2 – Continuous Hinges
- 1 – Lockset (Function A-special classroom)
- 2 – Cylinder Cores
- 2 – Manual Flush Bolts
- 1 – Dust Proof Strike
- 2 – Door Stop / Holders
- 2 – Door Closers (Par. arm)
- 2 – Armor Plates
- 2 – Silencers

Set No. 36

- 1 – Pivot Set Stanley No. 327
- 1 – Lockset (Function G-classroom)
- 1 – Cylinder Core
- 1 – Overhead Door Stop / Holder
- 3 – Silencers

END OF SECTION

SECTION 088000

GLAZING

(Part of Work of Section 080002 - GLASS AND GLAZING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Glass and glazing for the following products and applications:
 - a. Steel doors, frames and sidelights specified in Section 081110 - HOLLOW METAL DOORS AND FRAMES.
 - b. Wood doors specified in Section 081400 - FLUSH WOOD DOORS.
 - c. Aluminum doors specified in Section 084113 - ALUMINUM-FRAMED ENTRANCES.
 - d. Skylights specified in Section 086300 - METAL-FRAMED SKYLIGHTS.
 - e. Interior borrowed lites.
 - f. Unframed mirrors.
 - B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 1. Refer to section 018113 - Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 1. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for glazed curtain walls.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

- D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for 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.
- F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
 - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As required by Code.
 - b. Specified Design Snow Loads for Sloped Glazing: As required by Code.
 - c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
 - 1) Load Duration: 60 seconds or less.
 - d. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.
 - 1) Load Duration: 30 days.
 - e. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
 - 1) For monolithic-glass lites heat-treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
 - f. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.

- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 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 with lites 6.0 mm thick and a nominal 1/2-inch-wide interspace.
 4. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
 - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
 - b. Solar Heat Gain Coefficient: NFRC 200.
 - c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples: For the following products, in the form of 12-inch- square Samples for glass.
1. Each color of tinted float glass.
 2. Each type of patterned glass.
 3. Coated vision glass.
 4. Ceramic-coated spandrel glass.
 5. Each pattern and color of ceramic-coated vision glass.
 6. Fire-resistive glazing products.
 7. Each type of laminated glass with colored interlayer.
 8. Insulating glass for each designation indicated.
 9. For each color (except black) of exposed glazing sealant indicated.
 10. For each pattern, color, and type of glazing film.
- D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- E. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.
- F. Qualification Data: For installers.

- G. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- H. Product Test Reports: For each of the following types of glazing products:
 - 1. Tinted float glass.
 - 2. Coated float glass.
 - 3. Fire-resistive glazing products.
 - 4. Insulating glass.
 - 5. Glazing sealants.
 - 6. Glazing gaskets.
- I. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. 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..
- B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass, laminated glass and insulating glass.
- C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.
- D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- E. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
 - 1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 2. Submit not fewer than eight pieces of each type of material, 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 sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
 - G. **Glazing for Fire-Rated Assemblies:** Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
 - H. **Safety Glazing Products:** Comply with testing requirements in 16 CFR 1201.
 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency] acceptable to authorities having jurisdiction.
 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
 - I. **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 Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
 - J. **Insulating-Glass Certification Program:** Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:
 1. Insulating Glass Certification Council.
 - 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. Build mockup for types of windows indicated, in locations shown on Drawings.
 - L. **Preinstallation Conference:** Conduct conference at Project site to comply with requirements in Division 01.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

- B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 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 liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to the Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Ten years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to the Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to the Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 INSULATING-GLASS UNITS

- A. Insulating-Glass Units for Vertical Glazing: 1 inch thick insulating glass consisting of two lites of 1/4 inch glass, low e coating on the No. 2 surface and argon gas filled. Tempered where required. Provide one of the following or equal:
 - 1. VE1-2M by Viracon.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.25.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.
 - 2. Solarban 60 by PPG Industries.
 - a. Visible Light Transmittance: 70 percent.
 - b. Reflectance Visible Light: 11 percent.
 - c. U Value (Winter): 0.29.

- d. Shading Coefficient: 0.44.
- e. Solar Heat Gain Coefficient: 0.38.
- 3. SN-68 by Guardian Industries.
 - a. Visible Light Transmittance: 68 percent.
 - b. Reflectance Visible Light: 10 percent.
 - c. U Value (Winter): 0.29.
 - d. Shading Coefficient: 0.43.
 - e. Solar Heat Gain Coefficient: 0.37.

B. Insulating-Glass Units for Sloped Glazing and Gymnasium Glazing:

- 1. Provide insulated glass units as specified hereinabove for south and west facades with the following exception:
- 2. Indoor Lite: 5/16 inch, clear laminated glass with minimum 0.060 inch interlayer, as required to comply as a Type II safety glass material.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. AFG Industries, Inc.; Krystal Klear.
- b. Guardian Industries Corp.; Ultrawhite.
- c. Pilkington North America; Optiwhite.
- d. PPG Industries, Inc.; Starphire.

C. 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).

D. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

- 1. Tint Color: As selected by the Architect.
- 2. Visible Light Transmittance: As standard with manufacturer.

E. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.

F. Patterned Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Form 3 (patterned); and of quality, finish, and pattern specified.

G. 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 for Framed Units: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
 2. Construction for Units with Exposed Edges: Laminate glass with cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 3. Interlayer Thickness: 0.030 in. thick for vertical glazing, 0.060 in. thick for sloped glazing.
 4. Interlayer Color: Clear unless otherwise indicated.
- H. Fire-Rated Monolithic Ceramic Glazing Material (Not for Temperature-Rise-Rated Doors): Proprietary product in the form of clear flat sheets of 3/16-inch nominal thickness weighing 2.5 lb/sq. ft. and as follows:
1. Fire-Protection Rating: As indicated for the fire window in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Product: "Premium FireLite" (polished on both surfaces) by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.
- I. Fire-Rated Laminated Ceramic Glazing Material (Not for Temperature-Rise-Rated Doors): Proprietary Category II safety glazing product in the form of 2 lites of clear ceramic glazing material laminated together to produce a laminated lite of 5/16-inch nominal thickness; polished on both surfaces; weighing 4 lb/sq. ft. and as follows:
1. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Polished on both surfaces, transparent.
 3. Product: "FireLite Plus" by Nippon Electric Glass Co., Ltd., and distributed by Technical Glass Products.
- J. Laminated Glass with Intumescent Interlayers (Temperature-Rise-Rated Doors): Laminated glass made from multiple plies of uncoated, clear float glass; with intumescent interlayers; complying with testing requirements in 16 CFR 1201 for Category II materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. InterEdge, Inc., a subsidiary of AFG Industries, Inc.; Pyrobel.
 - b. Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
 - c. Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.
- K. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interpane air space, and complying with ASTM E774 for Class CBA units and with requirements specified in this Section.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" paragraph.
 2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's Standard Sealants. Butyl primary and silicone secondary sealants. Secondary sealant shall cover entire spacer bar at IGU perimeter.

5. Spacer Specifications: Manufacturer's standard spacer material. Spacer corners shall be bent, soldered, or welded. Keyed spacer corners will not be accepted. Spacer may have a mid-span spacer key located at the midpoint of the insulating glass unit head. Where a mid-span spacer key is used, the key must be fully embedded (all sides) in butyl sealant.
- L. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B, Type I, Quality-Q3, and complying with other requirements specified.
 1. Glass: Clear float.
 2. Ceramic Coating Color: Custom color as selected by the Architect ..
- M. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
 1. Mirror Edge Treatment: Flat polished edge.
- N. Glazing Film: Translucent, dimensionally stable, cast PVC film, 2-mil-minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
 1. Manufacturers: Subject to compliance with requirements, available manufacturer's that may be incorporated into the Work include, but are not limited to, the following:
 - a. Avery Dennison, Graphics.
 - b. FDC Graphic Films, Inc.
 - c. Madico, Inc.
 - d. 3M Scotchcal Dusted Crystal.
 2. Comply with requirements for safety glazing.
 3. Use: Suitable for exterior and interior applications.
 4. Patterns: As selected by Architect from manufacturer's full range.

2.3 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 1. Compatibility: Verify glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
 4. Adhesives and sealants that are 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):
 - a. Structural Glazing Adhesives: 100 g/L.
 - b. Architectural Sealants: 250 g/L.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants:

- a. Dow Corning Corporation; 790.
- b. GE Silicones; SilPruf LM SCS2700.
- c. Tremco Inc.; Spectrem 1.

C. **Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.**

2.4 GLAZING TAPES

- A. **Back-Bedding Mastic Glazing Tapes:** Preformed, butyl-based elastomeric tape with a solids content of 100 percent; 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; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for project conditions.
- B. **Expanded Cellular Glazing Tapes:** Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
 1. Type 1, for glazing applications in which tape acts as the primary sealant.
 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 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 with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. **Edge Blocks:** Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. **Perimeter Insulation for Fire-Resistive Glazing:** Identical to product used in test assembly to obtain fire-resistance rating.
- G. **Mirror Mastic:** An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- H. **Mirror Hardware, Top and Bottom Aluminum J-Channels:** Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

2.6 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze 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 in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- 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 sealant-substrate 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 as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- 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. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
- K. **Glazing Film: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.**

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first 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 just before each glazing unit is installed.
- F. 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.

3.5 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.

3.6 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 nonpermanent labels, and clean surfaces.
- 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 substances immediately as recommended 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.

END OF SECTION

SECTION 089000
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed extruded-aluminum louvers and frames.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for louvers that are a part of mechanical equipment.

1.3 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. Drainable-Blade Louver: 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.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and wind 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 on vertical projection of louvers. Loads as required by Code.
- B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions as required by code.

- C. Thermal Movements: Provide louvers 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 deg F ambient; 180 deg F material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other Work. Show blade profiles, angles, and spacing.
 - 1. For installed louvers indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Verification: For each type of metal finish required.
- E. Qualification Data: For professional engineer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
- C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify louver openings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Louvers and Vents:
 - a. Airolite Company, LLC.
 - b. Construction Specialties, Inc.
 - c. Greenheck.
 - d. Industrial Louvers, Inc.
 - e. McDermott Metal Works Corporation
 - f. Nystrom Building Products.
 - g. Ruskin Company.

2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Of same basic metal and alloy as fastened metal or 300 Series stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.
- D. 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 per ASTM E 488, conducted by a qualified independent testing agency.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.3 FABRICATION, GENERAL

- A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- C. 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.
- D. Include supports, anchorages, and accessories required for complete assembly.
- E. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.
 - 1. Fully Recessed Mullions: Provide mullions fully recessed behind louver blades. Where length of louver exceeds fabrication and handling limitations, fabricate with close-fitting blade splices designed to permit expansion and contraction.

- F. 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.

2.4 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal Storm-Resistant Louvers:

- 1. Louver Depth: 4 inches.
- 2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.080 inch.
- 3. Performance Requirements:
 - a. Free Area: Comply with requirements indicated on the Drawings.
 - b. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rain fall rate of 3 inches per hour and a wind speed of 29 mph at a core area intake velocity of 300 fpm.
- 4. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. High-Performance Organic-Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- 1. Fluoropolymer Three-Coat Coating System: Manufacturer's standard three-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color and Gloss: As selected by Architect to match adjacent curtain wall.

2.5 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

- 1. Screen Location for Fixed Louvers: Interior face.
- 2. Screening Type: Bird screening..

B. Secure screens 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.

D. Louver Screening for Aluminum Louvers:

- 1. Bird Screening: Aluminum, 1/2-inch-square mesh, 0.063-inch wire.

2.6 BLANK-OFF PANELS

A. Insulated, Blank-off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with metal sheets.

- 1. Thickness: 1 inch.
- 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.

3. Insulating Core: Rigid insulation board.
4. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch PVC compression gaskets.
5. Panel Finish: Same finish applied to louvers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 INSTALLATION

- A. Locate and place louvers and vents 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. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- F. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 - JOINT SEALANTS for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- 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 and vents 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

SECTION 090002

TILE

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090002- TILE

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
to be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. All Work of Section 093000 - TILING

END OF SECTION

SECTION 090003

ACOUSTICAL TILE

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090003- ACOUSTICAL TILE

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
to be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. All Work of Section 095110 - ACOUSTICAL CEILINGS

END OF SECTION

SECTION 090005

RESILIENT FLOORS

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090005- RESILIENT FLOORS

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings: *to be inserted with final documents.*

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. All Work of Section 096510 - RESILIENT FLOORING AND ACCESSORIES

END OF SECTION

SECTION 090007

PAINTING

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Sub-Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 090007- PAINTING

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
to be inserted with final documents.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. All Work of Section 099000 - PAINTING AND COATING

END OF SECTION

SECTION 092110

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Interior gypsum wallboard.
2. Tile backing panels.
3. Acoustic insulation in gypsum wallboard assemblies.
4. Non-load-bearing steel framing.
5. Installation of access panels.
6. Marking and identification for fire- and smoke-partitions.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 054000 - COLD-FORMED METAL FRAMING for load-bearing steel framing.
2. Section 061600 - SHEATHING for gypsum sheathing at exterior assemblies.
3. Section 083110 - ACCESS DOORS AND FRAMES for installation in gypsum board assemblies.
4. Section 092120 - GYPSUM BOARD SHAFT WALL ASSEMBLIES for framing, gypsum panels, other components of shaft wall assemblies, and finishing gypsum board shaft wall assemblies.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.

1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.

- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or

penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.5 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Drywall Recycling: All new paper-faced gypsum wallboard scrap (cuts from construction but not demolition waste) shall be recycled by Gypsum Recycling America LLC or approved equal.
- D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
 1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 3. Simulate finished lighting conditions for review of mockups.
 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products 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.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
 - 2. Protective Coating: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.
- B. Contractor's Option: Provide ProSTUD Drywall Framing System as manufactured by Clarkwestern Dietrich Building Systems LLC, or approved equal.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
 - a. Type: Postinstalled, expansion anchor.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.
- E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; Drywall Furring System.
 - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.0312 inch.
- B. Slip-Type Head Joints: Where indicated, provide one of the following:
 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiClip Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Fire Stop 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 compatible with studs and in width to accommodate depth of studs.
 1. Grace Construction Products; FlameSafe FlowTrak System.
 2. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
 3. Metal-Lite, Inc.; The System.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Minimum Base-Metal Thickness: 0.0312 inch.
- E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: 1-1/2 inches.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base Metal Thickness: 0.0312 inch.
 2. Depth: 1-1/2 inches.

- G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.
- H. Resilient Sound Isolation Clips: Provide galvanized steel and resilient material sound-isolation clips, equal to the following:
 - 1. Kinetics Noise Control Co.; IsoMax.
 - 2. PAC International, Inc.; RSIC-1.
 - 3. Pliteq, Inc.; GenieClip.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- K. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.4 INTERIOR GYPSUM BOARD

- 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. USG Corporation.
 - 2. Georgia-Pacific (G-P) Gypsum LLC.
 - 3. National Gypsum Company.
- B. Gypsum Wallboard: ASTM C 1396.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.
- C. Fire-Resistant Type X: ASTM C 1396.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.
- D. Flexible Type: ASTM C 1396. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch.
 - 2. Long Edges: Tapered.
- E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.
- F. Impact-Resistant Type: ASTM C1278, C1629. High-density paperless gypsum and cellulose wall panels manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

G. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. National Gypsum Company; Permabase Cement Board.
 - d. USG Corporation; DUROCK Cement Board.
2. Thickness: 5/8 inch.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.
 - e. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: 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.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.
 - 2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation.; SHEETROCK Acoustical Sealant.
3. Acoustical Sealant for Concealed Joints:
 - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
 - b. Pecora Corp.; BA-98.
 - c. Tremco, Inc.; Tremco Acoustical Sealant.

2.9 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. Safety Supply Warehouse.
2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, 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.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive

materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754. Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within $1/8$ inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install studs so flanges within framing system point in same direction.
- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on doorframes; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb, unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum $1/2$ -inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- D. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Z-Furring Members:

1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.7 APPLYING INTERIOR GYPSUM BOARD

A. 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 to minimize end joints.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. 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 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.8 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.1, at locations indicated to receive tile, with joints treated to comply with ANSI A108.11.
- B. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.9 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 C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.10 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. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 4: Panel surfaces that will be exposed to view (typical panels).
 - 4. Level 5: Where indicated on Drawings.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.11 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. **Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.**

3.12 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 092120

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Gypsum board shaft wall assemblies.
 - 2. Marking and identification for fire- and smoke-partitions.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 083110 - ACCESS DOORS AND FRAMES
 - 2. Section 092110 - GYPSUM BOARD ASSEMBLIES for non-shaft-wall gypsum board assemblies.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for applying and finishing panels in gypsum board shaft wall assemblies.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Provide gypsum board shaft wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.
 - 2. Provide gypsum board shaft wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.

- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
 3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.
 4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.5 SUBMITTALS

- A. Product Data: For each gypsum board shaft wall assembly indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft wall assembly's required fire-resistance rating.
1. Include data substantiating that elevator entrances and other items that penetrate each gypsum board shaft wall assembly do not negate fire-resistance rating.

1.6 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products," UL's "Fire Resistance Directory," or ITS's "Directory of Listed Products."
- B. STC-Rated Assemblies: For gypsum board shaft wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01. Review methods and procedures for installing work related to gypsum board shaft wall assemblies including, but not limited to, the following:
1. Fasteners proposed for anchoring steel framing to building structure.
 2. Sprayed fire-resistive materials applied to structural framing.
 3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
 4. Wiring devices in shaft wall assemblies.
 5. Doors and other items penetrating shaft wall assemblies.
 6. Items supported by shaft wall-assembly framing.
 7. Mechanical work enclosed within shaft wall assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. American Gypsum Co.
 - 2. G-P Gypsum Corp.
 - 3. National Gypsum Company.
 - 4. United States Gypsum Co.

2.2 ASSEMBLY MATERIALS

- A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
 - 1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
 - 2. Provide auxiliary materials complying with gypsum board shaft wall assembly manufacturer's written recommendations.
- B. Steel Framing: ASTM C 645.
 - 1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.
- D. Gypsum Wallboard: ASTM C 1396, core type as required by fire-resistance-rated assembly indicated.
- E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 092110 - GYPSUM BOARD ASSEMBLIES comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Section 092110 - GYPSUM BOARD ASSEMBLIES.
- G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

- H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
 - 2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.
- I. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- J. Acoustical Sealant: As recommended by gypsum board shaft wall assembly manufacturer for application indicated.
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- K. Sound Attenuation Blankets: ASTM C 665 for Type I, unfaced mineral-fiber-blanket insulation produced by combining thermosetting resins with mineral fibers manufactured from slag or rock wool.

2.3 GYPSUM BOARD SHAFT WALL

- A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.
- B. Sustained Air-Pressure Loads: 5 lbf/sq. ft.
- C. Deflection Limit: L/240.
- D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
 - 1. Depth: As indicated.
 - 2. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches in depth matching studs.
 - 1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0341 inch thick.

- G. Room-Side and Shaft-Side Finish: As indicated.
- H. STC Rating: As indicated.
- I. Cavity Insulation: Sound attenuation blankets.

2.4 IDENTIFICATION LABELS FOR FIRE- AND SMOKE-PARTITIONS

- A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire Wall Signs, Inc.
 - b. Safety Supply Warehouse.
 - 2. Text: "FIRE AND SMOKE BARRIER-PROTECT ALL OPENINGS"

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway doorframes, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 - APPLIED FIREPROOFING.
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
 - 1. ASTM C 754 for installing steel framing and gypsum shaft wallboard.

- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. At elevator hoistway doorframes, provide jamb struts on each side of doorframe.
 - 2. Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
- D. Integrate stair hanger rods with gypsum board shaft wall assemblies by locating cavity of assemblies where required to enclose rods.
- E. At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- G. Install control joints to maintain fire-resistance rating of assemblies.
- H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.
- I. In elevator shafts where gypsum board shaft wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft wall framing.

3.4 FINISHING GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.

2. Level 2: Panels that are substrate for tile.
3. Level 4: Panel surfaces that will be exposed to view (typical panels).
4. Level 5: Where indicated on Drawings.

3.5 INSTALLING IDENTIFICATION FOR FIRE- AND SMOKE-PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093000

TILING

(Part of Work of Section 090002 - TILE, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wall tile.
 - 2. Elastomeric sealants for expansion, contraction, control, and isolation joints in tile surfaces.
 - 3. Surface preparation for tile and accessories.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealing of joints between dissimilar materials.
 - 2. Section 083110 - ACCESS DOORS AND FRAMES for installation in tile.
 - 3. Section 092110 - GYPSUM BOARD ASSEMBLIES for cementitious backer units.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Verification:

1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch lengths.

E. Qualification Data: For Installer.

F. Material Test Reports: For each tile-setting and -grouting product.

1.4 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Joint sealants.
2. Cementitious backer units.
3. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 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 requirement in ANSI A137.1 for labeling sealed 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 avoided.

D. Store liquid additives in unopened containers and protected from freezing.

1.6 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

2.1 MANUFACTURERS

A. Available Manufacturers:

1. Ceramic Wall Tile (glazed):
 - a. Basis of Design: Daltile; Div. of Dal-Tile International Inc.
 - b. H&R Johnson Ceramics
 - c. United States Ceramic Tiles
 - d. American Olean.
 - e. Approved equal
2. Tile Setting Products:
 - a. Custom Building Products.
 - b. LATICRETE International Inc.
 - c. MAPEI Corporation.

2.2 TILE PRODUCTS

A. Ceramic Wall Tile (Toilet Rooms) as follows:

1. Basis of Design Product: *Daltile, Modern Dimensions*, or equal by approved manufacturer.
2. Tile Size: 4-1/4" x 8-1/2".
3. Finish: Semi-Gloss and matte.
4. Color/ Pattern: A multi-colored custom random pattern shall be provided as selected by Architect from full range of solid colors and mottled colors utilizing up to 4 different colored tiles in each room from full range in Dal Tile price groups 1, 2, and 4, or equal. Pattern to include 50% group 1, 25% group 2, and 25% group 4.

B. Ceramic Wall Tile (Corridors) as follows:

1. Basis of Design Product: *Daltile, Veranda*, or equal by approved manufacturer.
2. Tile Size: 6-1/2" x 20".
3. Finish: Semi-Gloss and matte.
4. Color/ Pattern: A multi-colored custom random pattern shall be provided as selected by Architect from full range of solid colors and mottled colors utilizing up to 4 different colored tiles in each room from full range in Dal Tile price groups 1, 2, and 4, or equal. Pattern to include 50% group 1, 25% group 2, and 25% group 4.

C. Glazed Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:

1. Base for Thin-Set Mortar Installations (typical): Cove, module size to match adjacent wall tile.
2. External Corners for Thin-Set Mortar Installations: Surface bullnose.
3. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

2.3 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 - 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- E. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes selected from manufacturer's standard shapes.
- F. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- G. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 - 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. Bonsal American; an Oldcastle company.
 - b. Bostik, Inc.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. Summitville Tiles, Inc.
 - f. TEC; a subsidiary of H. B. Fuller Company.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- H. Polymer-Modified Tile Grout: ANSI A118.7.
 - 1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
 - a. Unsanded grout mixture for joints 1/8 inch and narrower.
 - b. Sanded grout mixture for joints 1/8 inch and wider.

- I. 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.
- J. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

2.4 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated. Comply with applicable requirements in Section 079200 - JOINT SEALANTS.
 - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
 - 1. Available Products:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - d. Tremco, Inc.; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
 - 1. Available Products:
 - a. Bostik; Chem-Calk 550.
 - b. Tremco, Inc.; Vulkem 245.
 - c. Pecora Corporation; NR-200 Urexpan.
 - d. Tremco, Inc.; THC-900.

2.5 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. 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 before installing tile.
 - 3. 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.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. 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.
- D. 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.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. 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.

- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.
- H. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
- I. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

3.5 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 grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.6 TILE INSTALLATION SCHEDULE

- A. Wall Tile Installation 1: Interior wall installation over sound, dimensionally stable masonry or concrete; thin-set mortar; TCA W202 and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.

- B. Wall Tile Installation 2: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244C and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.

- C. Wall Tile Installation 3: Interior wall and shower-receptor installation over cementitious backer units; thin-set mortar; TCA B415, TCA W244, and ANSI A108.5.
 - 1. Thin-Set Mortar: Latex-portland cement mortar.
 - 2. Grout: Polymer-modified unsanded grout.
 - 3. Joint Width: 1/16 inch.

END OF SECTION

SECTION 095100

ACOUSTICAL CEILINGS

(Part of Work of Section 090003 - ACOUSTICAL TILE, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Acoustical ceiling tiles and panels.
 - 2. Suspension systems, grid systems and ceiling hangers.
 - 3. Acoustical sealant at edge moldings at acoustical ceilings.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 092110 - GYPSUM BOARD ASSEMBLIES for gypsum board ceilings and soffits.
 - 2. Division 21 - FIRE PROTECTION for fire-suppression components located in ceilings.
 - 3. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING for air handling and distribution components located in ceilings.
 - 4. Division 26 - ELECTRICAL for light fixture and alarm system components located in ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension members.

2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
1. Acoustical Panel: Set of 6 inch square Samples of each type, color, pattern, and texture.
 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.
- E. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.
- F. Maintenance Data: For finishes to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Source Limitations:
1. Acoustical Ceiling Panels: Obtain each type through one source from a single manufacturer.
 2. Suspension Systems: Obtain each type through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
 2. Surface-Burning Characteristics: Provide acoustical panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
- C. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 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.

1.6 PROJECT 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.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Products: Subject to compliance with specified requirements, provide one of the following products for each type indicated.
- B. Ceiling Type ACT-1A:
 - 1. Manufacturer and Model Number:
 - a. USG, Mars ClimaPlus No. 86985.
 - b. Certainteed Ceilings, Symphony M. 1222F-OVT-1.
 - c. Armstrong, Ultima No. 1912, with Beveled Tegular edge. (Basis of Design)
 - 2. Panel Size: 24 inches by 24 inches by 3/4 inch.
 - 3. Panel Mounting: Revealed edge.
 - 4. Noise Reduction Coefficient (NRC): Not less than 0.70.
 - 5. Ceiling Attenuation Class (CAC): Not less than 35.
 - 6. Color: White.
 - 7. Grid Material: Painted steel.
 - 8. Grid Face Width: 9/16 inch.
- C. Ceiling Type ACT-1B
 - 1. Manufacturer and Model Number:
 - a. USG, Mars ClimaPlus No. 88985 with FLB edge.
 - b. Certainteed, Symphony M No. 1220-OVT-1 with Narrow Reveal edge
 - c. Armstrong, Ultima No. 1915, with Beveled Tegular edge. (Basis of Design)
 - 2. Panel Size: 24 inches by 48 inches by 3/4 inch.
 - 3. Panel Mounting: Revealed edge.

4. Noise Reduction Coefficient (NRC): Not less than 0.70.
 5. Ceiling Attenuation Class (CAC): Not less than 35.
 6. Color: White.
 7. Grid Material: Painted steel.
 8. Grid Face Width: 9/16 inch.
- D. Ceiling Type ACT-2 (Music):
1. Manufacturer and Model Number:
 - a. USG, Sheetrock Brand Gypsum Lay-In, PVC Free No. 3220. (Basis of Design)
 - b. Certainteed, equal product.
 - c. National Gypsum, equal product.
 2. Panel Size: 24 inches by 24 inches by 1/2 inch.
 3. Panel Mounting: Flush with grid.
 4. Ceiling Attenuation Class (CAC): Not less than 35.
 5. Color: White.
 6. Grid Material: Painted steel with aluminum cap.
 7. Grid Face Width: 15/16 inch.
- E. Ceiling Type ACT-3 (Kitchen):
1. Manufacturer and Model Number:
 - a. Armstrong, Ceramaguard Panels, unperforated #605 with AL Prelude Plus Grid. (Basis of Design)
 - b. Certainteed Ceilings, approved equal.
 - c. USG, approved equal.
 2. Panel Size: 24 inches by 48 inches by 3/4 inch.
 3. Panel Mounting: Square edge.
 4. Noise Reduction Coefficient (NRC): Not less than 0.55.
 5. Ceiling Attenuation Class (CAC): Not less than 30.
 6. Color: White.
 7. Grid Material: Painted aluminum.
 8. Grid Face Width: 15/16 inch.
- F. Ceiling Type ACT-4, (Locker Rooms):
1. Manufacturer and Model Number:
 - a. Armstrong, Armatuff. 860 with square edge. (Basis of Design)
 - b. USG, equal product.
 - c. Certainteed, equal product.
 2. Panel Size: 24 inches by 48 inches by 3/4 inch.
 3. Panel Mounting: Flush with grid.
 4. Noise Reduction Coefficient (NRC): Not less than 0.50.
 5. Ceiling Attenuation Class (CAC): Not less than 33.
 6. Color: White.
 7. Grid Material: Painted steel.
 8. Grid Face Width: 15/16 inch
 9. Hold down clips: Provide manufacturers recommended hold-down clips.
- G. Ceiling Type ACT-6, (Gymnasium):
1. Manufacturer and Model Number:
 - a. Tectum, Conceal Corridor Ceiling Panels. (Basis of Design)
 - b. Approved equal.
 2. Panel Size: 24 inches by 96 inches by 2 inches.
 3. Panel Mounting: Flush with grid.
 4. Color: White.
 5. Grid Material: Painted steel.

6. Grid Face Width: 15/16 inch
7. Hold down clips: Provide manufacturers recommended hold-down clips.

2.2 METAL SUSPENSION SYSTEMS

- A. 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 C 635.
1. Manufacturer: USG, Armstrong, Certainteed Ceilings, or Chicago Metallic.
 2. Structural Classification: Intermediate-duty system.
 3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 4. Face Design: Flat, flush.
 5. Cap Material: Steel or aluminum cold-rolled sheet.
 6. Color: White, prefinished.
 7. Grid Face Width: As specified with ACT type.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service.
 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.
- D. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

2.3 METAL EDGE MOLDINGS AND TRIM

- A. 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 fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. 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.
 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
 - B. Shadow Molding: Provide shadow molding #7873 as manufactured by Armstrong World Industries, Inc.; or approved equal.
 - C. Suspension Trim: Subject to compliance with requirements, provide one of the following:
 1. Armstrong World Industries, Inc.; Axiom.
 2. BPB USA; Approved equal.
 3. USG Interiors, Inc.; Compasso
- 2.4 ACOUSTICAL SEALANT
- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

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. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 6. Do not attach hangers to steel deck tabs.
 7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged 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. 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.
 2. 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.
- 3.4 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

SECTION 096110

VAPOR MITIGATION AT SLABS

(UNIT PRICE WORK ONLY)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vapor mitigation at concrete slabs.
 - 2. Underlayment over floors receiving vapor mitigation.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete substrates.
 - 2. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for sheet flooring moisture requirements.
 - 3. Section 096810 - TILE CARPETING for carpet tile.
 - 4. Section 096820 - SHEET CARPETING for carpet sheet.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Qualification Data: For Installer.
- D. Field quality-control test reports.
- E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of vapor mitigation coatings required for this Project.
- B. Source Limitations: Obtain coatings from a single manufacturer.
- C. Prior to start of work the concrete substrates shall be tested by the Special Inspector in accordance with the manufacturer's recommendations. Tests shall be approved by the manufacturer's representative.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels showing the following information:
 - 1. Manufacturer's brand name.
 - 2. Type of material.
 - 3. Directions for storage.
 - 4. Date of manufacture and shelf life.
 - 5. Lot or batch number.
 - 6. Mixing and application instructions.
- B. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Do not apply moisture vapor reduction system to unprotected surfaces or when water is accumulated on the surface of the concrete.
- B. Do not apply water vapor reduction system when temperature is lower than 50° F or expected to fall below this temperature within 24 hours from time of application.
- C. Allow continuous ventilation and indirect air movement at all times during application and curing process of the water vapor reduction system.
- D. Protection: Protect water vapor reduction system to prevent damage from active rain or topical water for a minimum period of 24 hours from time of application.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace systems that deteriorate during the specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Available Manufacturers: Provide products by one of the following:

1. Ardex Engineered Cements; Ardex MC Moisture Control System.
2. Koster American Corporation; Koester VAP 1 2000 System.
3. Laticrete International Inc.; Drytek MVB.

2.2 MATERIALS

- A. General: Use materials of one manufacturer throughout the project as hereinafter specified.
- B. Water-based primer/curing agent, 100% solids coating, containing specifically formulated chemicals and resins to provide the following characteristics:
 1. ASTM E 96, Water Vapor Transmission (wet methods) Performance shall be documented by an independent testing laboratory at a minimum 90% for water vapor transmission reduction compared to untreated concrete.
 2. ASTM D 1308; Insensitivity to alkaline environment up to pH 14.
 3. Certify acceptance and exposure to continuous topical water exposure after final cure.
- C. Sand (as required): Fines sand less than 1/50 in. in grain size or 98.5% passing sieve size #30 or #35.
- D. Underlayment (as required): Hydraulic-cement-based, polymer-modified, self-leveling product complying with ASTM C 387, that can be applied in minimum uniform thicknesses of 1/4 inch and that can be feathered at edges to match adjacent floor elevations.
 1. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
 2. Compressive Strength: Not less than 5500 psi at 28 days when tested according to ASTM C 109/C 109M.
 3. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.
- E. Water: Potable and at a temperature of not more than 70 deg F.

2.3 SYSTEM

- A. Provide manufacturer's standard system, consisting of one to three coats, applied to a properly prepared concrete surface.
 1. The water vapor reduction system shall be required to reduce vapor emissions by a minimum of 90% after final cure.
 2. Provide compatible crack filler for cracks in excess of 1/32 inch.

2.4 MIX DESIGNS FOR VAPOR MITIGATION COATING

- A. Use clean containers and mix thoroughly as per Manufacturer's requirements to obtain a homogeneous mixture. Use a low speed motor less than 400 rpm and a two bladed Jiffy mixing blade only. DO NOT AERATE. Mix ratios are measured by volume.
- B. Mix Ratio: Mix Component A and B at a ratio recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements and for other conditions affecting performance of traffic coatings.
 - 1. Prepare written report listing conditions detrimental to performance.
 - 2. Verify compatibility with and suitability of substrates.
 - 3. Begin coating application only after minimum concrete curing and drying period recommended by manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
 - 4. Application of coating indicates acceptance of surfaces and conditions.
- B. Calcium Chloride Test Requirements:
 - 1. Anhydrous calcium chloride testing shall be performed by the Special Inspector as outlined in Section 014320 - QUALITY CONTROL AND TESTING SERVICES.
 - 2. Provide anhydrous calcium chloride tests in accordance with ASTM F 1869 for surface preparation methods outlined. Tests shall be installed onto freshly abraded contaminant free concrete
 - 3. Conduct calcium chloride tests at the same temperature and humidity expected during normal use. Maintain these conditions 48 hours prior to and during tests. Water vapor transmission levels are directly affected by ambient room temperature and readings conducted without a sustained ambient temperature are NOT acceptable.
 - 4. Special Inspector shall provide test results on a marked up floor finish plan showing test results. Owner's Special Inspector shall provide a written clarification on status of the ambient air temperature and humidity before and during the testing procedures.
 - 5. Special Inspector shall provide a marked up floor plan showing areas with vapor reduction system recommendations.
 - 6. Test for concrete deficiencies and contaminates such as un-reacted silicates, chlorides, A.S.R. (alkali-silica reaction); as recommended by manufacturer.
- C. Adhesion Tests: The Special Inspector shall verify proper adhesion of flooring adhesives, coatings, and leveling compounds to the final vapor reduction coating system for acceptability.

3.2 PREPARATION

- A. Manufacturer's representative shall inspect surfaces with regard to their suitability to receive moisture vapor reduction system with manufacturer's representative.
- B. Repair concrete prior to moisture vapor reduction system installation as recommended by manufacturer.
- C. Clean all surfaces to receive moisture vapor reduction system as recommended by manufacturer.
- D. Mechanically scarify, shot or bead blast, the surface to obtain an ICRI profile of CSP 3 (Light shot-blast).
- E. Clean surfaces with vacuum to remove residue off the substrate. Remove defective materials, and foreign matter such as dust, adhesives, leveling compounds, paint, dirt, floor hardeners, bond breakers, oil, grease, curing agents, form release agents, efflorescence, laitance. Shot blast bees, etc. Repair cracks, expansion joint, control joints, and open surface honeycombs and fill in accordance with manufacturer's recommendations. Reinforcing fibers

must be burned off, scraped and vacuumed, after shot blasting, leaving no fibers left on the concrete surfaces. Provide uncontaminated, sound surface.

- F. Acid etching will not be accepted.

3.3 APPLICATION - VAPOR MITIGATION COATING

- A. System Application: Apply as recommended by manufacturer at a rate recommended by manufacturer.
- B. Primer: Apply a uniform coat at manufacturer's recommended rate of coverage with a paint roller working the primer into the surface.
- C. Systems requiring sand broadcast at primer shall use fine sand spread uniformly over the entire area.
- D. Top Coat: Apply a uniform coat at a 90 deg. angle to primer coat at manufacturer's recommended rate of coverage.
- E. Systems requiring sand broadcast at top coat shall use fine sand spread uniformly over the entire area.

3.4 APPLICATION - UNDERLAYMENT

- A. Preparation: After a minimum of 16 hours, broom sweep and vacuum the surface providing clean, prepared surface.
- B. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - 2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- C. Apply underlayment to produce uniform, level surface.
 - 1. Apply a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.5 CLEANING

- A. Remove debris resulting from water vapor reduction system installation from project site.

3.6 PROTECTION

- A. Protect each coat during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION

SECTION 096460

WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wood athletic flooring assemblies.
 - 2. Field finishing of work of this Section, including striping and line work as indicated.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Items To Be Installed Only:
 - 1. Section 116620 – ATHLETIC EQUIPMENT for floor plate and sleeve assemblies.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wood sports-floor assemblies.
- B. Shop Drawings: Show installation details including location and layout of each type of floor assembly and accessory. Include the following:
 - 1. Expansion provisions and trim details.
 - 2. Layout, colors, widths, and dimensions of game lines and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring assembly.
- C. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches long and of same thickness and material indicated for the Work.

1. Include sample sets showing the full range of normal color and texture variations expected in wood flooring.
 2. Include sample sets showing finishes and game-line paint and marker paint colors applied to wood flooring.
- D. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Source Limitations: For field-finished wood flooring, obtain each species, grade, and cut of wood from one source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Installer Qualifications: An experienced installer who has completed wood sports-floor assembly installations similar in material, design, and extent to that indicated for this Project and whose work has resulted in installations with a record of successful in-service performance.
1. Installer responsibilities include installation and field finishing of sports-floor assembly components and accessories, and application of game lines and markers.
- C. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
- D. Mockups: Install mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. To set quality standards for installation, install mockup of floor area as shown on Drawings.
 2. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area as shown on Drawings.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.
- 1.6 PROJECT CONDITIONS
- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.

1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Connor Sports Flooring, Inc.
 2. Mondo.
 3. Robbins, Inc.
 4. Superior Floor Company, Inc.

2.2 WOOD FLOORING

- A. Strip Flooring: Northern hard maple (*Acer saccharum*), kiln dried, random length, tongue and groove, and end matched.
1. Grade: MFMA-RL Second and Better.
 2. Cut: Flat.
 3. Thickness: 25/32 inch.
 4. Face Width: 2-1/4 inches.
 5. Backs: Channeled (kerfed) for stress relief.
 6. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.

2.3 SUBFLOOR SYSTEM

- A. Plywood Underlayment: APA rated, C-D Plugged, exterior glue, tongue and groove, 15/32 inch thick.
- B. Wood Sleepers: Standard grade; 48 inches long; kiln-dried Eastern hemlock, fir, pine, or spruce.
1. Preservative Treatment: Clear, penetrating, water-repellent wood preservative that protects against mold, mildew, staining, and decay fungi; complying with MFMA's written recommendations and applied by immersion.
 2. Size: Nominal 2 by 3 inches.

3. Sleeper Anchors: Manufacturer's standard, but not less than steel drive pins recommended by anchor manufacturer to achieve minimum 900-lbf pullout strength.
 4. Sleeper Shims: In size and type recommended in writing by flooring manufacturer for application indicated.
- C. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
1. Type: Recycled rubber.
- D. Acoustical Underlayment: 6 mm thick rubber sheet underlayment, equal to Sound Shark.
- ## 2.4 ACCESSORY MATERIALS
- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 8.0 mils thick.
- B. Resilient Wall Base: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches; with premolded outside corners.
1. Color: Custom color.
- C. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
- D. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.
- E. Adhesives: Manufacturer's standard for application indicated.
1. Concrete Primers: Manufacturer's standard for application indicated.
 2. Use adhesive and primer, if any, that have a VOC content of 100 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Floor-Finish System: System of compatible components recommended in writing by flooring manufacturer and MFMA approved.
1. Type: MFMA Group 5, Water Based Finishes; polyurethane.
 2. Floor-Sealer Formulation: Pliable, penetrating type.
 3. Finish-Coat Formulation: Formulated for gloss finish and multicoat application.
 4. Game-Line and Marker Paint: Industrial enamel compatible with finish coats and recommended in writing by manufacturers of finish coats, and paint for this use.
 5. VOC content: Provide products that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Floor Sealers and Finish Coats: VOC content of not more than 350 g/L.
 - b. Game-Line and Marker Paint: VOC content of not more than 150 g/L.
 - c. School logo at center jump circle: VOC content of not more than 150 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
 - 1. Verify that substrates comply with tolerances and other requirements specified in other Sections.
 - 2. For adhesively applied wood flooring, verify that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Substrate Moisture Testing, General: Perform tests recommended by manufacturer or, if none, comply with applicable recommendations in NWFA's "Installation Guidelines: Wood Flooring".
 - 1. Proceed with installation only after substrates pass testing.
- C. Concrete Moisture Testing: Perform anhydrous calcium chloride test per ASTM F 1869, as follows:
 - 1. Perform tests so that each test area does not exceed 200 sq. ft. and perform not less than 2 tests in each installation area with test areas evenly spaced in installation area.
 - 2. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - 3. Perform alkalinity and adhesion tests recommended in writing by manufacturer or, if none, according to NWFA's "Installation Guidelines: Wood Flooring". Proceed with installation only after substrates pass testing.

3.2 PREPARATION

- A. Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.
 - 1. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- B. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with sports-floor assembly manufacturer's written instructions, but not less than written recommendations of MFMA applicable to flooring type indicated.
- B. Pattern: Lay flooring parallel with long dimension of space to be floored, unless otherwise indicated.

- C. Expansion Spaces: Provide as indicated, but not less than that required by manufacturer's written instructions and MFMA's written recommendations at walls and other obstructions, and at interruptions and terminations of flooring.
 - 1. Cover expansion spaces with base molding, trim, and saddles, as indicated on Drawings.
- D. Vapor Retarder: Install with joints lapped a minimum of 6 inches and sealed.
- E. Underlayment: Install perpendicular to direction of flooring, staggering end joints in adjacent rows.
- F. Sleepers:
 - 1. Install perpendicular to direction of flooring, staggering end joints a minimum of 24 inches,
 - 2. Space at spacing recommended by manufacturer for system components indicated.
 - 3. Anchor predrilled sleepers through resilient pads.
- G. Strip Flooring: Mechanically fasten perpendicular to supports.
- H. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 SANDING AND FINISHING

- A. Follow applicable recommendations in MFMA's "Industry Recommendations for Sanding, Sealing, Court Lining, Finishing, and Resurfacing of Maple Gym Floors."
- B. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.
- C. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups. Remove sanding dust by tack or vacuum.
- D. Finish: Apply seal and finish coats of finish system according to finish manufacturer's written instructions. Provide not less than four coats total and not less than two finish coats.
 - 1. Water-Based Finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
 - 2. Game Lines and Markers: Apply game-line and marker paint between final seal coat and first finish coat according to paint manufacturer's written instructions.
 - a. Mask flooring at game lines and markers, and apply paint to produce lines and markers with sharp edges.
 - b. Where game lines cross, break minor game line at intersection; do not overlap lines.
 - c. Apply game lines and markers in widths and colors according to requirements indicated on Drawings.
 - d. Apply finish coats after game-line and marker paint is fully cured.

3.5 PROTECTION

- A. Protect sports floors during remainder of construction period to allow finish to cure and to ensure that flooring and finish are without damage or deterioration at time of Substantial Completion.

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1. Do not cover sports floors after finishing until finish reaches full cure, and not before seven days after applying last finish coat.
2. Do not move heavy and sharp objects directly over sports floors. Protect fully cured floor finishes and surfaces with plywood or hardboard panels to prevent damage from storing or moving objects over sports floors.

END OF SECTION

SECTION 096510

RESILIENT FLOORING AND ACCESSORIES

(Part of Work of Section 090005 - RESILIENT FLOORS, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Linoleum tile floor covering.
 - 2. Rubber sheet floor covering.
 - 3. Resilient wall base and accessories.
 - 4. Resilient stair accessories.
 - 5. Substrate preparation for resilient flooring and accessories.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 096810 - TILE CARPETING for carpet accessories.
 - 2. Section 096820 - SHEET CARPETING for carpet accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 1. Show details of special patterns.
- D. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
 2. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- E. Seam Samples for Sheet Flooring: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch. Sample applied to a rigid backing and prepared by Installer for this Project.
- F. Maintenance Data: For resilient products to include in maintenance manuals.
- 1.4 QUALITY ASSURANCE
- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.
- 1.6 PROJECT CONDITIONS
- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg 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. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 LINOLEUM FLOOR TILE

- A. Floor Tile: ASTM F 2195, Type I, linoleum floor tile with fibrous backing.
1. Forbo Flooring, Inc. (Basis of Design)
 2. Tarkett Inc.
 3. Armstrong World Industries, Inc.
- B. Style and Colors: As indicated on the Finish Schedule

- C. Thickness: 2.0 mm.
- D. Size: 24 by 24 inches.

2.2 RUBBER SHEET FLOOR COVERING

- A. Unbacked Rubber Sheet Floor Covering: ASTM F 1859, Type I (homogeneous rubber sheet).
 - 1. Estrie Products International, American Biltrite (Canada) Ltd.
 - 2. Flexco.
 - 3. Johnsonite.
 - 4. Mondo Rubber International, Inc.
 - 5. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
 - 6. R.C.A. Rubber Company (The).
- B. Style and Colors: As indicated on the Finish Schedule.
- C. Thickness: As standard with manufacturer.
- D. Wearing Surface: Molded pattern.
 - 1. Molded-Pattern Figure: Raised discs.
- E. Sheet Width: As standard with manufacturer.
- F. Seaming Method: Standard.

2.3 RESILIENT WALL BASE

- A. Wall Base: ASTM F 1861.
 - 1. Armstrong World Industries, Inc.
 - 2. Azrock Commercial Flooring, DOMCO
 - 3. Burke Mercer Flooring Products
 - 4. Johnsonite
 - 5. Marley Flexco (USA), Inc.
 - 6. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
 - 7. Roppe Corporation
- B. Style and Colors: As indicated on the Finish Schedule.
- C. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic).
- D. Shape: Straight (toeless) at carpet and coved at resilient flooring.
- E. Minimum Thickness: 0.125 inch.
- F. Height: 4 inches.
- G. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- H. Outside Corners: Premolded.
- I. Inside Corners: Premolded.

J. Surface: Smooth.

2.4 RESILIENT STAIR ACCESSORIES

A. Treads and Risers: FS RR-T-650.

1. Burke Mercer Flooring Products
2. Endura
3. Johnsonite
4. Mondo Rubber International, Inc.
5. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
6. Roppe Corporation

B. Style and Colors: As indicated on the Finish Schedule.

C. Material: Rubber, Composition A.

D. Size: Lengths and depths to fit each stair tread in one piece.

E. Stringers: Of same thickness as risers, height and length after cutting to fit risers and treads and to cover stair stringers; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

2.5 RESILIENT MOLDING ACCESSORY

A. Types Include the Following as Applicable: Cap for cove carpet, cap for cove resilient sheet floor covering, carpet edge for glue-down applications, nosing for carpet, nosing for resilient floor covering, reducer strip for resilient floor covering, joiner for tile and carpet

1. Burke Mercer Flooring Products
2. Johnsonite
3. Marley Flexco (USA), Inc
4. Roppe Corporation

B. Material: Rubber.

C. Profile and Dimensions: As indicated.

2.6 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 manufacturer to suit resilient products and substrate conditions indicated.

1. Provide manufacturer's recommended adhesives designed for use on concrete slabs with relative humidity up to 85 percent, and 81 lbs. of pressure. Adhesive shall be compatible with moisture mitigation system (as applicable).
2. Use adhesives certified as low-emitting materials in accordance with either the Scientific Certification System's Indoor Advantage Gold program, Scientific Certification System's FloorScore program, or GreenGuard's Children and Schools program. Or, the product may be listed at www.chps.net in the CHPS Products Database. Alternatively,

manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page 83.

- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: Match floor covering.
 - 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
- D. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
- F. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
 - 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.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing:
 - a. Perform test to determine pH of concrete surface. No flooring shall be installed at pH higher than 9, or as otherwise required in writing by manufacturer of flooring.
 - b. Perform strip adhesion tests using adhesive and flooring material proposed for use.
 - c. Perform additional tests recommended by manufacturer.
 - d. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform relative humidity test using in situ probes, ASTM F 2170-11. Proceed with installation only after substrates have a relative humidity level of 75 percent or other level acceptable to flooring manufacturer.
 - b. Perform additional tests recommended by manufacturer.

- c. Proceed with installation only after substrates pass testing.

- C. 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.

- D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

- E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are same temperature as space where they are to be installed.

- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SHEET INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor coverings.

- B. Unroll floor coverings and allow them to stabilize before cutting and fitting.

- C. Lay out floor coverings as follows:
 - 1. Maintain uniformity of floor covering direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 - 3. Match edges of floor coverings for color shading at seams.
 - 4. Avoid cross seams.

- D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

- E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

- F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.

- G. Install floor coverings on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of floor coverings installed on covers and adjoining floor covering. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

- H. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

- I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.
 2. Chemically-Bonded Seams: Bond seams with chemical-bonding compound to permanently fuse sections into a seamless floor covering. Prepare seams and apply compound to produce tightly-fitted seams without gaps, overlays, or excess bonding compound on floor covering surfaces.
- J. Integral-Flash-Cove Base: Cove floor coverings up vertical surfaces as indicated on Drawings. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.

3.4 TILE INSTALLATION

- A. Lay out 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 in pattern indicated.
- B. Match 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.
- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere 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.

3.5 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.

- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.

3.6 RESILIENT ACCESSORY INSTALLATION

- A. 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.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.7 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products 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. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes as per manufacturer written recommendations for each type of floor finish.
 - a. Coordinate selection of floor polish with the Owner's maintenance service.
 - 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
 - 3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 096566

RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Include GENERAL CONDITIONS and applicable parts of Division 1 as part of this Section.
- B. Examine all other sections of the Specifications for requirements that affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. Furnish and install synthetic athletic sports surface as indicated in the Drawings, as specified herein, or both.
- B. The Work of this Section includes, but is not limited to, the following:
 - 1. Sports surface flooring.
 - 2. Substrate preparation for resilient flooring and accessories.
- C. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
 - 3. Low-emitting materials: All products in this section shall be certified as low-emitting materials in accordance with either the Scientific Certification System's Indoor Advantage Gold program, Scientific Certification System's FloorScore program, or GreenGuard's Children and Schools program. Additionally, systems as specified herein shall be tested and evaluated for emissions of VOCs of concern with respect to chronic inhalation exposures following the specifications of the CDPH Standard Practice. Or, the product may be listed at www.chps.net in the CHPS Products Database. Alternatively, manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA).
- D. See Drawings for locations and details.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. Related work includes but is not limited to the following work covered in other sections:

1. Concrete subflooring: Section 033000 – Cast-in-Place Concrete.
2. Resilient base at perimeter of flooring: Section 096500 – Resilient Flooring.

1.4 INDOOR AIR QUALITY REQUIREMENTS

- A. Volatile Organic Compounds: All coatings specified in this section shall comply with the following limits on content and emission of VOC's:
 1. Surface layer coating for sports surface flooring: Maximum 150 grams/liter total VOC's.
 2. Adhesive for weight room flooring: Maximum 150 grams/liter total VOC's.
- B. VOC Certification: All paint and coating products specified in this section shall be certified and labeled accordingly to demonstrate that they meet the requirements of the Green Seal Organization.

1.5 SUBMITTALS

- A. Submit the following in accordance with the provisions of Division 1.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Submit plans of each area receiving synthetic sports surfacing. Show locations of inserts and layout of game lines and markings, where required.
- D. Samples: Submit manufacturer's color samples for Architect's selection. After selection, submit sample of synthetic sports surface, 8" by 10" in specified thickness, color and texture with lane markings, for approval.
- E. Literature: Submit manufacturer's technical data on characteristics, performance and maintenance of all products.
- F. IAQ Submittals: For each product that contains VOC's, comply with submittal requirements specified in Section 018119 – Indoor Air Quality Requirements.
- G. Test Reports.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall have successfully completed within the last three (3) years three (3) synthetic sports surface flooring applications of similar type and size. Mechanics from these earlier applications shall be used on this project, one of whom shall serve as lead mechanic.
- B. Single Source Responsibility: Obtain synthetic flooring materials including primers, resins, hardening agents, finish and sealing coats from a single manufacturer with not less than five (5) years of successful experience in supplying materials for work of type described in this Section. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.
- C. Provide certified independent testing agency to perform moisture testing (in-situ probes). Demonstrate qualifications in the form of a submittal and submit certified test reports and procedures

that will be reviewed and verified by the Owner's Testing Agency.

1.7 DELIVERY AND STORAGE

- A. Deliver all materials to the job site in original, unopened packages and containers bearing manufacturer's name and contents.
- B. All materials shall be stored in designated locations in a manner that meets requirements of applicable codes and fire regulations and complies with manufacturer's directions for preventing damage and deterioration. Materials shall be stored in an area with a minimum temperature of 55° F, and maximum relative humidity of 50%.
- C. Materials shall be delivered in sufficient quantities in advance of time needed in order that the Work not be delayed in any way.

1.8 GUARANTEE

- A. Submit written guarantee signed jointly by the manufacturer of the sports surface and the flooring applicator, against defects in materials and workmanship for a period of not less than two (2) years from the date of Substantial Completion.
- B. Such guarantee shall be in addition to and not in lieu of all other liabilities that manufacturer or Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. Connor Sport Court International, Inc.
 - 2. Robbins Sports Flooring Systems.
 - 3. Surface America, Inc.
 - 4. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Robbins Sports Flooring Systems, to establish the general character and materials required for athletic flooring for this project. Equivalent products by acceptable manufacturers will be approved.

2.2 GYMNASIUM FLOORING

- A. General: Provide a seamless three-layer synthetic resilient sports surface system, comprising a shock pad, structural layer and seamless resurfaceable wear layer for a durable surface with good traction and shock absorptive properties.
 - 1. Product: Connor Sport Court International, Inc. ElastiPlus, or equal by approved manufacturer.
- B. Three-layer construction:

1. Shock pad: 9.0mm:
 - a. Adhesive: Two-component polyurethane adhesive as approved by manufacturer of flooring system.
 - b. Base mat: Polyurethane-bound granulated rubber sheet.
 - c. Base mat sealer: Two-component polyurethane sealer.
 2. Reinforcement: Polyester textile reinforcement mesh.
 3. Wear layer: 2.0mm:
 - a. Polyurethane resin: Pigmented two-component polyurethane resin.
 - b. Coating: Pigmented two-component polyurethane paint.
- C. Flooring material shall meet or exceed the following requirements:
1. Surface hardness, per DIN 53505: 80/A (+/-5).
 2. Coefficient of friction: 0.53.
 3. Wear resistance, per Taber H18:
 - a. 1.7% volume after 500 cycles.
 - b. 1.9% volume after 1000 cycles.
 4. Resistance to a 100 kilogram rolling load, per DIIN 18032: No damage.
 5. Flammability, per DIN 51960: Class 1/Not flammable.
- D. Colors: As selected by Architect from manufacturer's full range.
1. Patterns: Provide up to three colors per room, in proportions as required to produce custom, random, and curvilinear patterns as shown on drawings.
- E. Game Lines and Artwork: Use compatible coatings with matte texture in up to 6 colors as selected by Architect.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated. Provide an average of 1/8" thick leveling patching compound on all new and existing slab surfaces to receive resilient flooring.

PART 3 - EXECUTION

3.1 EXAMINATION AND CORRECTION OF SURFACES

- A. Contractor is required to provide slabs level to within 1/8" in 10 feet in any direction. No curing agents or sealers shall be applied to the concrete on which athletic flooring will be installed.
- B. If variation in concrete sub-surface exceeds 1/8" in 10 feet, Contractor shall correct conditions by grinding down concrete, the use of leveling compound or other method acceptable to the flooring manufacturer.
- C. Examine surfaces and ensure that conditions are suitable to receive work under this Section. Commencement of work in any area shall constitute acceptance of surface as being satisfactory. All defects of work resulting from use of such accepted surface shall be corrected by the synthetic sports surface applicator at no additional cost to the Owner.

3.2 PROJECT CONDITIONS

- A. The following additional requirements shall be met prior to installation of synthetic surfacing.
- B. Electrical work shall be completed so that ample lighting and outlet power are available during installation.
- C. The building shall be dry and closed in before installation begins.
 - 1. During cold weather, room temperature shall be maintained at a minimum level of 65° F and a maximum level of 75° F.
 - 2. Room moisture content shall be within manufacturer's required limits as tested daily with a sling psychrometer by the surfacing applicator, both prior to and during the course of installation of flooring.
 - 3. Reduction of room dampness, if required, shall be the responsibility of the General Contractor who shall use heat, ventilation and fans as required.
- D. Perform tests for moisture and adhesion prior to application, and report adverse conditions to the Contractor in writing.
- E. No smoking, open flames, or electrical work emitting sparks shall be allowed in the area during application of materials.

3.3 PREPARATION

- A. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing:
 - a. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a relative humidity level of 75 percent or other level acceptable to flooring manufacturer.
 - b. Perform additional moisture tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

3.4 INSTALLATION OF SPORTS SURFACE FLOORING

- A. General: Install sports flooring in accordance with manufacturer's printed instructions.
- B. Install base mat and reinforcement:
 - 1. Unroll sports flooring and allow sheets to relax.
 - 2. Cut and adjust sheets prior to adhesion of flooring to substrate.
 - 3. Mix adhesive and apply in accordance with manufacturer's instructions.
 - 4. Hold all seams in place with suitable weights for a minimum of twelve hours.
 - 5. Mix sealer and apply to top surface of pad.
 - 6. Place reinforcement netting over the sealed surface with edges overlapping 4".
 - 7. Apply additional sealer using a straight trowel and allow to cure for a minimum of 12 hours before proceeding.
 - 8. In locations adjacent to doorways, feather sports surface down to thresholds.
- C. Install wear surface:

1. Mix pigmented polyurethane resin and spread over sealed mat using a straight trowel and allow to cure for a minimum of 12 hours.
 2. Mix pigmented finish coating and apply using manufacturer's recommended lambswool roller.
 3. Allow finish coat to cure a minimum of 48 hours before proceeding.
- D. Game Lines and artwork: Apply lines using approved marking paint in colors selected by the Architect. As many as four (4) colors may be selected. Edges shall not be scored in surface. Architect will provide layout of lines.

3.5 PROTECTION

- A. Surfacing applicator shall arrange with the General Contractor to close off traffic and other work from areas of application. No traffic shall be permitted on resilient athletic flooring systems for a period of one week following the completion of each flooring system.
- B. General Contractor shall be responsible for proper protection of flooring after completion. Flooring shall be covered with non-staining protective covering as necessary.
- C. The General Contractor shall be responsible for removal of protective covering and for final cleaning at the time of Substantial Completion.

3.6 MAINTENANCE INSTRUCTIONS AND ADDITIONAL MATERIALS

- A. Furnish two (2) sets of printed maintenance instructions and sufficient materials to repair thirty (30) square feet of surface, to authorized representatives of the Owner and obtain a signed receipt.
- B. Provide instructions for repair and patching using materials furnished.

END OF SECTION

SECTION 096710

POURED EPOXY FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Poured epoxy flooring systems.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for sealants installed at joints in resinous flooring systems.

1.3 PERFORMANCE REQUIREMENTS

- A. Chemical Resistance:
 - 1. Request from the Owner detailed information for these agents including concentration utilized and frequency of application for each.
 - 2. Certify in writing to the Owner and Architect that resinous flooring systems can resist repeated exposure to these agents.

1.4 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. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Provide floor plans, to scale matching Architectural Plans, which indicate extent of each different resinous flooring system including system type, color and pattern, degree of slip resistance, and dimensioned locations of control joints and seams where systems meet.

1. Provide enlarged details, at minimum 3 inch = 1 foot scale, indicating conditions at walls, door frames, pits, curbs, equipment pedestals, etc.
- D. Samples for Verification: For each resinous flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.
- E. Material Certificates: For each resinous flooring component, signed by manufacturer.
- F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- G. Maintenance Data: For resinous flooring to include in maintenance manuals.
- H. Test Results: For field testing of substrate, signed by installer.

1.5 QUALITY ASSURANCE

- A. 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 employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
 2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. 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- square floor area selected by Design Professional.
 - a. Include 48-inch length of integral cove base.
 2. Simulate finished lighting conditions for Design Professional's review of mockups.
 3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-installation Conference: Prior to installation of flooring, meet at the Project site with the Manufacturer's Representative, Installer, Architect, and Owner. Record discussions and furnish copy to each participant. Topics to be discussed shall include, but not be limited to:
 1. Existing and new slab conditions.
 2. Results of mandatory testing.
 3. Surface preparation.
 4. Required room temperatures.
 5. Ventilation.
 6. Step-by-step application procedures.
 7. Curing time and methods.

8. Protection of completed Work.

1.6 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.

1.7 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 ambient air temperature between 65oF and 85oF.
 2. Type I Concrete substrate shall be properly cured for a minimum of 30 days. Type III Concrete shall be properly cured for a minimum of 7 days.
- 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.

1.8 WARRANTY

- A. Manufacturer shall furnish a single, written warranty covering 100% of the material and labor costs protecting the client from delamination, disbondment, and osmotic/hydrostatic failure for a period of three (3) years from date of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Crossfield Products Corp.
 2. Stonhard, Inc.
 3. Tnemec Company Inc.
- B. Systems:
 1. Troweled epoxy mortar with clear epoxy receiving coat, decorative quartz broadcast and clear epoxy sealer coat.
- C. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.2 RESINOUS FLOORING SYSTEM

- A. Troweled epoxy mortar with clear epoxy receiving coat, decorative quartz broadcast and clear epoxy sealer coat:
 - 1. Basis-of Design Product: "Stonshield HRI" by Stonhard, Inc.
- B. System Characteristics:
 - 1. Color: As selected by Architect from manufacturer's full range.
 - 2. Wearing Surface: Textured for slip resistance.
 - 3. Integral Cove Base: 4 inches high with 1 inch radius.
 - 4. Overall System Thickness: 3/16 inch (not including osmotic pressure barrier or grout).
 - 5. VOC: Less than 100 g/l.
- C. System Components: Manufacturer's standard components which are compatible with each other and as follows:
 - 1. Osmotic Pressure Barrier (if required): Three-component, polymer modified, cementitious grout for use under resinous flooring systems to be applied on concrete slabs on grade.
 - a. Basis-of Design Product: "Stonfil OP2" by Stonhard, Inc.
 - b. Thickness: 1/8 inch minimum, no thin film systems will be accepted.
 - c. Primer: "Stonfil OP2 Primer" by Stonhard, Inc.
 - 2. Primer: Type recommended by manufacturer for substrate and body coat(s) indicated.
 - 3. (option) Grout: 3-component, epoxy chemistry, compatible with flooring system, screeded and troweled to provide specified slope to drains
 - 4. Troweled Mortar (no slurry systems accepted):
 - a. Resin: 100 % solids epoxy
 - b. Application Method: Steel troweled, hand or power trowel
 - c. Aggregate: Silica
 - d. Thickness: minimum 1/8 in.
 - 5. Receiving Coat:
 - a. Resin: 100 % solids epoxy
 - b. Color: Clear
 - 6. Broadcast:
 - a. Aggregate: Ceramic coated quartz
 - b. Color: selected from manufacturer's full range
 - 7. Seal Coat(s):
 - a. Resin: 100% solids epoxy
 - b. Color: Clear
 - c. Number of Seal Coats: 2 for smoother than medium texture

2.3 METHYL METHACRYLATE ACRYLID (MMA) RESIN SYSTEM

- A. System: Provide DEGACLAD CF R61SL Methyl Methacrylate (MMA) Acrylic Resin System:
 - 1. Saturating Primer/Sealer Coat: Degadur R41i
 - 2. Coving: Degadur R61 with appropriate filler
 - 3. Patching/Sloping: Degadur R17 Polymer Concrete
 - 4. Topping: R61SL Self-Leveling, consisting of Degadur R61 resin and SRS Filler SL with Colored Flake broadcast.
 - 5. Topcoat, Two-Coats: Degadur R71 Colorless Topcoat Resin
 - 6. SRS Colored Flake for Broadcasting: Color/s to be chosen by Architect. If added skid resistance is required, bleached aluminum oxide, similar material may be broadcast into

the first topcoat to achieve specified skid/slip resistance requirements. Size and rate shall be determined by Architect

B. Product Performance Criteria:

1. Saturating Primer/Sealer:
 - a. Percentage Reactive Resin: 100%
 - 1) Percentage Solids: 100%
 - b. Water Absorption, Wt. % (ASTM D570): Less than 0.6
 - c. Tensile Strength, psi (ASTM D638): 3550
 - d. Tensile Modulus, psi X 10 to the 5th (ASTM D638): 2.1
 - e. Coefficient of Thermal Expansion, in./in./deg. F (ASTM D696): 0.000035
 - f. Electrical Resistivity (ASTM D257):
 - 1) Volume Resistance, ohm-cm: 1015
 - 2) Surface Resistance, ohm: 1012
 - g. Water Vapor Transmission (DIN 53122), g/cm-hr-mm Hg X 10-9: 1.4
2. Patching/Sloping Polymer Concrete
 - a. Percentage of reactive resin: 100%
 - b. Water Absorption, Wt. % (ASTM D570): 0.02
 - c. Tensile Strength, psi (ASTM D638): 1200
 - d. Tensile Modulus, psi X 10 to the 5th (ASTM D638): 1.2
 - e. Coefficient of Thermal Expansion, in./in./deg. F (ASTM D696) psi x10-6: 18
 - f. Compressive Strength, psi (ASTM C39): 7,800; (ASTM C109): 9,200
3. Topping:
 - a. Percentage of reactive resin: 100%
 - 1) Percentage of solids: 100%
 - b. Water Absorption, Wt. % (ASTM D570): 0.04
 - c. Compressive Strength, psi (ASTM C109): 6,000-8,000; (ASTM D695): 6,000
 - d. Tensile Strength, psi (ASTM D638): 1,050
 - e. Tensile Modulus, psi (ASTM D638): 720,000
 - f. Flexural Strength, psi (ASTM D790): 3,500
 - g. Coefficient of Thermal Expansion, in./in./deg. F (ASTM D696): 000019
 - h. Electrical Resistivity, (ASTM D257) Volume Resistance, ohm-cm: 1014
 - i. Chemical Resistance, ASTM D543:
 - 1) Effect of weak acids: none
 - 2) Effect of strong acids: slight
 - 3) Effect of alkalis: none
 - 4) Effect of salt solutions: none
 - 5) Effect of oil, grease: none
 - 6) Effect of sunlight (UV radiation): none
4. Topcoat Resin:
 - a. Percentage Reactive Resin: 100%
 - 1) Percentage Solids: 100%
 - b. Water Absorption, Wt. % (ASTM D570): 0.05
 - c. Tensile Strength, psi (ASTM D638): 3555
 - d. Tensile Modulus, psi (ASTM D638): 210,000
 - e. Coefficient of Thermal Expansion (ASTM D696) in./in./deg. F: 0.000035
 - f. Electrical Resistivity (ASTM D257):
 - 1) Volume Resistance, ohm-cm: 1015
 - 2) Surface Resistance, ohm: 1012
 - g. Water Vapor Transmission (DIN 53122) g/cm-hr-mm Hg X 10-9: 1.43
 - h. Chemical Resistance, ASTM D543:
 - 1) Effect of weak acids: none

- 2) Effect of strong acids: slight
- 3) Effect of alkalis: none
- 4) Effect of salt solutions: none
- 5) Effect of oil, grease: none
- 6) Effect of sunlight (UV radiation): none

2.4 ACCESSORY MATERIALS

- A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph 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. Roughen concrete 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.
 - b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
 3. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 4. Alkalinity and Adhesion Testing:
 - a. Perform test to determine pH of concrete surface. No flooring shall be installed at pH higher than 9, or as otherwise required in writing by manufacturer of flooring.
 - b. Perform strip adhesion tests using adhesive and flooring material proposed for use.
 - c. Perform additional tests recommended by manufacturer.
 - d. Proceed with installation only after substrates pass testing.
 5. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform relative humidity test using in situ probes, ASTM F 2170-11. Proceed with installation only after substrates have a relative humidity level of 75 percent or other level acceptable to flooring manufacturer.
 - b. Perform additional tests recommended by manufacturer.
 - c. Proceed with installation only after substrates pass testing.
- 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.

3.2 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 over prepared substrate at manufacturer's recommended spreading rate.
- C. Apply waterproofing membrane, where indicated, in manufacturer's recommended thickness.
 - 1. Apply waterproofing membrane to integral cove base substrates.
- D. Apply reinforcing membrane to substrate cracks.
- E. Integral Cove Base: 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.
- F. Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.
 - 1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.
- G. Apply troweled or screeded body coat(s) in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.
- H. Apply grout coat, of type recommended by resinous flooring manufacturer to fill voids in surface of final body coat and to produce wearing surface indicated.
- I. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- J. Apply chemical resistant coat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- K. Apply UV resistant topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- L. Apply slip resistant texture approved by Architect.

3.3 FIELD QUALITY CONTROL

- A. Testing and Monitoring Equipment Calibrations: Test and demonstrate to the Architect that calibrations on testing and monitoring equipment are providing accurate readings.

- B. Manufacturer's Field Service: Manufacturer shall send qualified technical representative to the Project site for the following purposes:
1. Coordinate schedule, environmental requirements, and pre-installation work with other trades.
 2. Advise Installer's personnel of procedures and precautions for use of flooring materials.
 3. Attend moisture testing and other testing procedures with the Architect, Owner and Installer in attendance.
 4. Observe field mock-ups with the Architect, Owner and Installer in attendance.
 5. Make periodic site visits and include record of observations in the applicator's project documentation log.
 6. Ascertain that each component of flooring system is being installed in accordance with manufacturer's instructions.
 7. Maintain a log of environmental conditions, work procedures, testing procedures, and protection measures to be included in job site file submittal.
- C. Testing of Floor Slabs:
1. Before installation of flooring, test floor slabs for containment of moisture and moisture vapor emission, pH, and alkalinity levels that would be detrimental to adhesion of resinous flooring materials.
 2. Complete the following moisture tests as described below and as documented in ASTM E 1907.
 - a. Testing of floor slabs for containment of moisture and moisture vapor emission shall be by calcium chloride test method in accordance with ASTM F 1869.
 - 1) For slabs on grade one test kit shall be placed for every 1000.sq. ft. of concrete slab area
 - 2) For elevated slabs one test kit shall be placed for every 5000 sq. ft. of concrete slab area
 - 3) Maximum transmission emission level for slabs on grade shall be 3 lbs of water per every 1000 sq ft. of floor slab area in 24 hour period.
 - 4) Maximum transmission emission level for elevated slabs shall be 3 lbs. of water per 5000 sq. ft. of floor slab area in 24 hour period.
 - 5) Protect against rewetting of concrete after testing.
 - 6) Coordinate environmental controls in advance and continuing for duration of flooring installation.
 - b. Perform plastic sheet tests per ASTM D 4263.
 - c. Perform relative humidity tests using probes per ASTM F 2170.
 3. Perform pH tests per ASTM F 710.
 4. Perform additional moisture tests recommended by manufacturer with Achitect's approval.
 5. Verify that concrete substrates have neutral pH and that resinous flooring will adhere. Proceed with application only after substrates successfully pass testing listed above.
- D. Testing Activities During Resinous Flooring Application: The following may be required by the Architect.
1. Core Sampling: At the direction of the Architect and at locations designated by the Architect, take 1 core sample per 100 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Installer to repair damage caused by coring and correct deficiencies.
 2. Material Sampling: Architect may at any time and any number of times during resinous flooring application require the Contractor to collect material samples for testing for compliance with requirements.
 - a. Material samples shall be taken, identified, sealed, and certified in presence of Architect.

- b. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures in addition to testing procedures listed in manufacturer's product data.
- 3. Adhesion Test: Conduct "pull-off" tests on installed flooring in accordance with ASTM D 4501. Certify that results conform to the manufacturer's published maximum for adhesive strength before failure.
- 4. If test results show applied materials do not comply with specified requirements, Contractor to pay for testing, remove non-complying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials in compliance with requirements.

3.4 CLEANING AND PROTECTING

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 096810

TILE CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Modular carpet tile.
 - 2. Carpet accessories.
 - 3. Substrate preparation for carpet and accessories.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for resilient wall base and accessories installed with carpet.
 - 2. Section 096820 - SHEET CARPETING for broadloom carpet.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. 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.

D. 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-long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

F. 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.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Before installing carpet tile, 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 undamaged at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. 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.

- D. Where equipment or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.7 WARRANTY

- A. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.

- 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Basis of Design: Provide Tandus, Estuary, Tributary, Trace; or approved equal.
 - 2. CHPS Requirement: Carpets installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institutes Green Label Plus Program.
 - 3. Color: As selected by Architect from manufacturers full range of options.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit carpet products and substrate conditions indicated.
 - 1. Provide manufacturer's recommended adhesives designed for use on concrete slabs with relative humidity up to 85 percent, and 81 lbs. of pressure. Adhesive shall be compatible with moisture mitigation system (as applicable).
 - 2. Use adhesives certified as low-emitting materials in accordance with either the Scientific Certification System's Indoor Advantage Gold program, Scientific Certification System's FloorScore program, or GreenGuard's Children and Schools program. Or, the product may be listed at www.chps.net in the CHPS Products Database. Alternatively, manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page 83.

PART 3 - EXECUTION

3.1 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 Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing:
 - a. Perform test to determine pH of concrete surface. No flooring shall be installed at pH higher than 9, or as otherwise required in writing by manufacturer of flooring.
 - b. Perform strip adhesion tests using adhesive and flooring material proposed for use.
 - c. Perform additional tests recommended by manufacturer.
 - d. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform relative humidity test using in situ probes, ASTM F 2170-11. Proceed with installation only after substrates have a relative humidity level of 75 percent or other level acceptable to flooring manufacturer.
 - b. Perform additional tests recommended by manufacturer.
 - c. Proceed with installation only after substrates pass testing.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "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.
- C. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: Partial glue down; install periodic tiles with releasable, 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 nonpermanent, nonstaining marking device.

- G. Install pattern parallel to walls and borders.

3.4 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, "Protection of 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 methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 096820

SHEET CARPETING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Carpet for direct glue-down installation.
 - 2. Carpet accessories.
 - 3. Substrate preparation for carpet and accessories.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 096510 - RESILIENT FLOORING AND ACCESSORIES for resilient wall base and accessories installed with carpet.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
 - 2. Carpet type, color, and dye lot.
 - 3. Seam locations, types, and methods.
 - 4. Type of subfloor.
 - 5. Type of installation.
 - 6. Pattern type, repeat size, location, direction, and starting point.
 - 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.

D. 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: 12-inch- square Sample.
2. Exposed Edge Stripping and Accessory: 12-inch-long Samples.
3. Carpet Seam: 6-inch Sample.

E. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.

F. Maintenance Data: For carpet to include in maintenance manuals specified in Division 01. Include the following:

1. Methods for maintaining carpet, 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.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Mockups: Before installing carpet, 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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

A. General: Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Basis of Design: Provide Tandus Flooring, Estuary, Tributary; or approved equal.
 - 2. CHPS Requirement: Carpets installed in the building interior shall meet the testing and product requirements of the Carpet and Rug Institutes Green Label Plus Program.
 - 3. Color: As selected by Architect from manufacturers full range of options.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the carpet manufacturer.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit carpet products and substrate conditions indicated.
 - 1. Provide manufacturer's recommended adhesives designed for use on concrete slabs with relative humidity up to 85 percent, and 81 lbs. of pressure. Adhesive shall be compatible with moisture mitigation system (as applicable).
 - 2. Use adhesives certified as low-emitting materials in accordance with either the Scientific Certification System's Indoor Advantage Gold program, Scientific Certification System's FloorScore program, or GreenGuard's Children and Schools program. Or, the product may be listed at www.chps.net in the CHPS Products Database. Alternatively, manufacturers may arrange for independent lab testing of materials to determine whether they meet the California Chronic Reference Exposure Levels (CRELs) as identified by the California Office of Environmental Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page 83.
- C. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Alkalinity and Adhesion Testing:
 - a. Perform test to determine pH of concrete surface. No flooring shall be installed at pH higher than 9, or as otherwise required in writing by manufacturer of flooring.
 - b. Perform strip adhesion tests using adhesive and flooring material proposed for use.
 - c. Perform additional tests recommended by manufacturer.
 - d. Proceed with installation only after substrates pass testing.
 - 3. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform relative humidity test using in situ probes, ASTM F 2170-11. Proceed with installation only after substrates have a relative humidity level of 75 percent or other level acceptable to flooring manufacturer.
 - b. Perform additional tests recommended by manufacturer.
 - c. Proceed with installation only after substrates pass testing.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
 - 1. **Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for glue-down installation.**
- B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.

- D. Cut and fit carpet 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 manufacturer.
- E. Extend carpet 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 nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 098430

SOUND-ABSORBING PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Back-mounted acoustical wall panels.
 - 2. Ceiling reflector panels.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking.
 - 2. Section 095100 - ACOUSTICAL CEILINGS for acoustical ceiling panels supported by exposed suspension system and tested for noise reduction.

1.3 DEFINITIONS

- A. NRC: Noise reduction coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of panel edge, core material, and mounting indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For acoustical wall panels. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.
- D. Coordination Drawings: Show intersections with wall base, electrical receptacles and switches, and other adjacent work.

- E. Samples for Initial Selection: For each type of fabric facing material from acoustical wall panel manufacturer's full range.
- F. Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.
 - 1. Fabric: Full-width by 36-inch-long Sample from dye lot to be used for the Work, and as follows:
 - a. With specified treatments applied.
 - b. Show complete pattern repeat.
 - c. Mark top and face of fabric.
 - 2. Panel Edge: 12-inch-long Sample showing edge profile, corner, and finish.
 - 3. Core Material: 12-inch-square Sample showing corner.
 - 4. Mounting Device: Full-size Sample.
 - 5. Sample Panels: No larger than 36 by 36 inches. Show joints and mounting methods.
- G. Product Certificates: For each type of acoustical wall panel, signed by product manufacturer.
- H. Qualification Data: For fabricator and testing agency.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of acoustical wall panel.
- J. Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.
- K. Warranty: Special warranty specified in this Section.

1.5 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. Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

- C. Protect panel edges from crushing and impact.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical wall panels 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.
- B. Lighting: Do not install acoustical wall panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.
- C. Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.
 - 1. Failure in performance includes, but is not limited to, acoustical performance.
 - 2. Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.
 - 3. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Decoustics.
 - 2. Kinetics Noise Control.
 - 3. MBI Products Company.
 - 4. Wall Technology / Conwed.
 - 5. Sound Concepts.
 - 6. Quiet Concepts

2.2 BACK-MOUNTED, EDGE-REINFORCED ACOUSTICAL WALL PANELS WITH GLASS-FIBER BOARD CORE

- A. Panel Construction: Manufacturer's standard panel construction consisting of facing material laminated to front face, edges, and back border of dimensionally stable, rigid glass-fiber board core; with edges chemically hardened to reinforce panel perimeter against warpage and damage.
- B. Glass-Fiber Board Core: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

- C. Nominal Core Density: 4 to 7 lb/cu. ft..
- D. Facing Material: Fabric from same dye lot; color and pattern as selected by Architect from manufacturer's full range.
 - 1. Manufacturer: As indicated on the Finish Schedule.
- E. Nominal Core Thickness and Overall System NRC: 1 inch and not less than NRC 0.80, for Type A mounting per ASTM E 795.
- F. Panel Width: As indicated on Drawings
- G. Panel Height: Fabricated height as indicated on Drawings.
- H. Panel Edge Detail: Square.
- I. Corner Detail: Square to form continuous profile to match edge detail.

2.3 REFLECTOR CLOUDS (FIELD CONSTRUCTED)

- A. Basis-of-Design: Ovation Reflector Panels as manufactured by Kinetics Noise Control, Inc.
 - 1. Radiused/bowed panel system consisting of a 3/4" 5-ply hardwood plywood core with 15 mil (.375 mm) gel coat on back of panel.
 - 2. Face: Maple veneer to match Architect's sample.
 - 3. Reflector Panel edges shall match the exposed face.
 - 4. Reflector Panels shall be fabricated to the sizes shown on the drawings as single units without visible joints or seams.
 - 5. Suspension and Flexing System: 1/8" (3 mm) steel angle painted black and 1/4" (6 mm) diameter zinc plated tensioning rods mounted on the top (unexposed) side of the Reflector Panel. Panels shall be flexed to a 25 ft radius before installation.
 - 6. Suspension System: 1/8" diameter, 7 x 19 stainless steel cable with cable thimble and double crimp sleeves. Suspension shall be securely fastened to existing concrete structural beams and/or to new structural steel beams.

2.4 FABRICATION

- A. Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.
- B. Acoustical Wall Panels: Panel construction consisting of facing material adhered to [face,] edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.
 - 1. Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.
- C. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.
 - 1. Where square corners are indicated, tailor corners.
 - 2. Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.

3. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.
- D. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
1. Thickness.
 2. Edge straightness.
 3. Overall length and width.
 4. Squareness from corner to corner.
 5. Chords, radii, and diameters.
- E. Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, and as follows:
1. As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fabric, substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.
- C. Match and level fabric pattern and grain among adjacent panels.
- D. Installation Tolerances: As follows:
1. Variation from Level and Plumb: Plus or minus 1/16 inch.
 2. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.3 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.
- B. Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION

SECTION 099000

PAINTING AND COATING

(Part of Work of Section 090007 - PAINTING, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Field painting of exposed interior items and surfaces.
 2. Field painting of exposed exterior items and surfaces.
 3. Surface preparation for painting.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 051200 - STRUCTURAL STEEL FRAMING for shop priming structural steel.
 2. Section 055000 - METAL FABRICATIONS for shop priming ferrous metal.
 3. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for shop priming interior architectural woodwork.
 4. Section 081110 - HOLLOW METAL DOORS AND FRAMES for factory priming steel doors and frames.
 5. Section 081400 - FLUSH WOOD DOORS for factory finishing.
 6. Section 092110 - GYPSUM BOARD ASSEMBLIES for surface preparation of gypsum board.

1.3 DEFINITIONS AND EXTENT

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.

4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.
- B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork.
 - b. Acoustical wall panels.
 - c. Metal toilet enclosures.
 - d. Metal lockers.
 - e. Kitchen appliances.
 - f. Elevator entrance doors and frames.
 - g. Elevator equipment.
 - h. Finished mechanical and electrical equipment.
 - i. Light fixtures.
 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Foundation spaces.
 - b. Furred areas.
 - c. Ceiling plenums.
 - d. Utility tunnels.
 - e. Pipe spaces.
 - f. Duct shafts.
 - g. Elevator shafts.
 3. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
 4. Operating parts include moving parts of operating equipment and the following:
 - a. Valve and damper operators.

- b. Linkages.
 - c. Sensing devices.
 - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
 3. Submit two eight inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.
- D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
 - b. Small Areas and Items: Architect will designate items or areas required.
 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.

- a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
 3. Final approval of colors will be from benchmark samples.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
 - B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule at the end of this Section.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. VOC Content for Interior Paints and Coatings: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 1. Flat Paints and Coatings: 50 g/L.
 - 2. Nonflat Paints and Coatings: 150 g/L.
 - 3. Dry-Fog Coatings: 400 g/L.
 - 4. Primers, Sealers, and Undercoaters: 200 g/L.
 - 5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
 - 6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
 - 7. Pretreatment Wash Primers: 420 g/L.
 - 8. Floor Coatings: 100 g/L.
 - 9. Shellacs, Clear: 730 g/L.
 - 10. Shellacs, Pigmented: 550 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
 - 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convactor covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
 - 1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 - 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 - 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
 - 1. Uninsulated metal piping.
 - 2. Uninsulated plastic piping.
 - 3. Pipe hangers and supports.
 - 4. Tanks that do not have factory-applied final finishes.
 - 5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 - 6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 - 7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- G. Electrical items to be painted include, but are not limited to, the following:
 - 1. Switchgear.
 - 2. Panelboards.
 - 3. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
 - 1. Provide satin finish for final coats.

- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
 - 1. The Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
 - 2. Testing agency will perform appropriate tests for the following characteristics as required by the Architect.
 - 3. The Architect may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 PAINT SCHEDULE

- A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.
- B. Exterior Paint Schedule:
 - 1. Exterior Masonry and Concrete to be Painted (where indicated):

One Coat	1.	Tnemec 156 Enviro-Crete at 6.0 to 10 mils DFT
	2.	Liquid Plastics Acrylic at 8.0 to 10.0 mils DFT
	3.	Dupont Tufcryl at 8.0 to 10.0 mils DFT
	4.	Amercoat 147 at 6.0 to 10.0 mils DFT

5. RD Coatings Elasto-Flex at 6.0 to 10.0 mils DFT
 6. Glidden Professional: Decraflex 300 Smooth, 2260 at 6.0 to 12 mils DFT
- And One Coat
1. Tnemec 156 Enviro-Crete at 8 to 10 mils DFT
 2. Liquid Plastics Acrylic at 8.0 to 10.0 mils DFT
 3. Dupont Tufcryl at 8.0 to 10.0 mils DFT
 4. Amercoat 147 at 6.0 to 10.0 mils DFT
 5. RD Coatings Elasto-Flex at 6.0 to 10.0 mils DFT
 6. Glidden Professional: Decraflex 300 Smooth, 2260 at 6.0 to 12 mils DFT
2. Exterior Ferrous Metal, Urethane System:
(Surface Preparation: SSPC-SP6)
- One Coat
1. Tnemec 90-1K97 at 3 mils DFT; shop applied under other Sections; use for touch up
 2. PPG PMC 68 at 3 mils DFT; shop applied under other Sections; use for touch up
 3. Dupont Urethane Ganicin Zinc Rich Primer 80%zinc load at 3.0 mils DFT
 4. International Interzinc 315 at 2.0 to 3.0 mils DFT
 5. Devoe Coatings: Cathacoat 302H at 2.0 to 3.0 mils DFT
- And One Coat
1. Tnemec N69 Hi-Build Epoxoline II at 3.0 mils DFT
 2. PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 5.0 mils DFT.
 3. Dupont 25P High Solids Epoxy at 4.0 to 6.0 mils DFT
 4. International Intergard 475 HS at 4.0 to 8.0 mils DFT
 5. Devoe Coatings: Devran 224HS at 4.0 – 6.0 mils DFT
- And One Coat
1. Tnemec 1075 Endura-Shield at 3.0 mils DFT
 2. PPG PMC Amerlock 450H Polyurethane Topcoat at 3.0 mils DFT
 3. Dupont High Solids Imron Urethane at 4.0 mils DFT
 4. International Interthane 990 HS at 2.0 to 3.0 mils DFT
 5. Devoe Coatings: Devthane 378 at 3.0 mils DFT
3. Exterior Ferrous Metal, Fluoropolymer System:
(Surface Preparation: SSPC-SP6)
- One Coat
1. Tnemec 90-1K97 at 3.0 mils DFT; use for touch up
 2. Dupont Ganicin Urethane Zinc Rich at 3.0 mils DFT
 3. PPG Coraflon ADS570 Zinc Rich Epoxy Primer at 3.0 mils DFT
- And One Coat
1. Tnemec V73 Endura-Shield at 3.0 mils DFT
 2. Dupont Imron HS at 3.0 mils DFT
 3. PPG Pitthane HB Urethane 95-8800 at 3.0 mils DFT
- And One Coat
1. Tnemec 1070 Fluoronar at 2.0 mils DFT with [1078 metallic] [1071 satin] [1072 semi-gloss] finish
 2. Dupont Fluoropolymer at 3.0 mils DFT
 3. PPG Coraflon ADS Fluoropolymer at 1.5-2.0 mils DFT
4. Exterior Galvanized Metal (not shop-finished under Section 051200 - STRUCTURAL STEEL FRAMING or Section 055000 - METAL FABRICATIONS):
(Surface Preparation: SSPC-SP7 Brush-off Blast)

- One Coat
 - 1. Tnemec N69 Epoxoline at 3.0 mils DFT
 - 2. PPG PMC Amerlock 400 Hi-Build Epoxy at 4.0-5.0 mils DFT
 - 3. Dupont 25P High Solids at 4.0 mils DFT
 - 4. International Intergard 475 HS at 5.0 to 10.0 mils DFT
 - 5. Devoe Coatings: Devran 224HS at 4.0 – 6.0 mils DFT

- And One Coat
 - 1. Tnemec V73 Endura-Shield at 3.0 mils DFT
 - 2. PPG PMC Amercoat 450H Polyurethane at 3.0 mils DFT
 - 3. Dupont Imron 2.8 Urethane at 3.0 to 4.0 mils DFT
 - 4. International Interthane 990 HS at 3.0 to 4.0 mils DFT
 - 5. Devoe Coatings: Devthane 379 at 3.0 mils DFT

- 5. Existing Exterior Painted Steel for Sandblasting and Finish:
(Surface Preparation- SSPC-SP 10 Near White Metal Blast)
(International doesn't make fluoropolymers, they recommend using polysiloxane - Interfine 878)
 - One Coat
 - 1. Tnemec 90-97 or 901K97 at 3 to 3.5 mils DFT
 - 2. PPG PMC Amercoat 68 HS at 3.0 mils DFT
 - 3. Dupont Ganicin 80% Zinc load Zinc Rich Primer at 3.0 to 3.5 mils DFT
 - 4. Devoe Coatings: Cathacoat 302H at 2 to 3 mils DFT

 - And One Coat
 - 1. Tnemec 1075 Endura-Shield at 3.0 to 4.0 mils DFT
 - 2. PPG PMC Amerlock 400 at 4.0 DFT
 - 3. Dupont Imron 2.8 at 4.0 to 5.0 mils DFT
 - 4. Devoe Coatings: Devthane 349QC at 4.0 to 6.0 mils DFT

 - And One Coat
 - 1. Tnemec 1070 Flouronar at 2.5 to 3.5 mils DFT
 - 2. PPG PMC Corolon Coating at 5.0 mils DFT
 - 3. Dupont Fluoropolymer at 3.0 mils DFT
 - 4. Devoe Coatings: Devthane 349QC at 4.0 mils DFT

- 6. Existing Exterior Painted Steel for Overcoat Finish:
(Surface Preparation : Water Blast 5000 psi and SSPC-SP3 Power Tool Clean)
 - One Coat
 - 1. Tnemec 394 Omnithane at 3.0 to 3.5 mils DFT
 - 2. PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 4.0 mils DFT
 - 3. RD Coatings Elasto Metal at 3.0 mils DFT
 - 4. International Interplus 356 at 3.0 to 5.0 mils DFT
 - 5. Devoe Coatings: Devguard 4360 at 3.0 mils DFT

 - And One Coat
 - 1. Tnemec N69 Epoxoline at 3.0 to 5.0 mils DFT
 - 2. PPG PMC Amerlock 400 at 3.0 to 4.0 mils DFT
 - 3. RD Coatings Elasto Metal at 7.0 mils DFT
 - 4. International Intergard 475 HS at 5.0 to 10.0 mils DFT
 - 5. Devoe Coatings: Devran 224HS at 4.0 to 6.0 mils DFT

 - And One Coat
 - 1. Tnemec 1075 Endura-Shield at 3.0 to 5.0 mils DFT
 - 2. PPG PMC Amercoat 450H at 3.0 mils DFT
 - 3. RD Coatings MurCryl at 3.0 to 4.0 mils DFT
 - 4. International Interthane 990 HS at 3.0 to 4.0 mils DFT
 - 5. Devoe Coatings: Devthane 378 at 3.0 mils DFT

C. Interior Paint Schedule for Standard Performance Coatings:

- 1. Interior Gypsum Wallboard and Plaster for Latex Eggshell Finish:

- One Coat
 - 1. Moore **Eco Spec WB** Interior Latex Primer (372)
 - 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Wall Primer
 - 4. PPG Pure Performance Latex Primer
 - 5. Glidden Professional Lifemaster No VOC Primer, 9116

- And Two Coats
 - 1. Moore **Eco Spec WB** Interior Latex Eggshell (374)
 - 2. Duron Genesis Latex Eggshell
 - 3. S-W Harmony Latex Eggshell
 - 4. PPG Pure Performance Latex Eggshell
 - 5. Glidden Professional Lifemaster No VOC Eggshell, 9300

- 2. Interior Gypsum Wallboard and Plaster Ceilings for Latex Flat Finish:
 - One Coat
 - 1. Moore **Eco Spec WB** Interior Latex Primer (372)
 - 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Wall Primer
 - 4. PPG Pure Performance Latex Primer
 - 5. Glidden Professional Lifemaster No VOC Primer, 9116

 - And Two Coats
 - 1. Moore **Eco Spec WB** Interior Latex Flat (373)
 - 2. Duron Genesis Latex Flat
 - 3. S-W Harmony Latex Flat
 - 4. PPG Pure Performance Latex Eggshell
 - 5. Glidden Professional Lifemaster No VOC Flat, 9100

- 3. Interior Gypsum Wallboard and Plaster for Latex Semi-Gloss Finish:
 - One Coat
 - 1. Moore **Eco Spec WB** Interior Latex Primer (372)
 - 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Wall Primer
 - 4. PPG Pure Performance Latex Primer
 - 5. Glidden Professional Lifemaster No VOC Primer, 9116

 - And Two Coats
 - 1. Moore **Eco Spec WB** Interior Latex Semi-Gloss (376)
 - 2. Duron Genesis Latex Semi-Gloss
 - 3. S-W Harmony Latex Semi-Gloss
 - 4. PPG Pure Performance Latex Semi-Gloss
 - 5. Glidden Professional Lifemaster No VOC S/G, 9200

- 4. Interior Architectural Woodwork, Finish Carpentry, and Wood Doors for Latex Semi-Gloss Paint Finish (softwoods, paint grade hardwoods, MDO, and hardwood veneers):
 - One Coat
 - 1. Moore **Eco Spec WB** Interior Latex Primer (372)
 - 2. Duron Genesis Latex Primer
 - 3. S-W Harmony Latex Primer
 - 4. PPG Pure Performance Latex Primer
 - 5. Glidden Professional Lifemaster No VOC Primer, 9116

 - And Two Coats
 - 1. Moore **Eco Spec WB** Interior Latex Semi-Gloss (376)
 - 2. Duron Genesis Latex Semi-Gloss
 - 3. S-W Health Spec Latex Semi-Gloss
 - 4. PPG Pure Performance Latex Semi-Gloss
 - 5. Glidden Professional Lifemaster No VOC S/G, 9200

5. Interior Architectural Woodwork, Finish Carpentry and Millwork for Satin Transparent Finish (all hardwoods and hardwood veneers, except paint grade and factory-finished items):

Sand 120 grit sandpaper
Sand 220 grit sandpaper

One Coat Stain 1. Carver Tripp Waterbase Stain
2. Knute's Restoration EF Waterbase Stain
3. American Formulating & Manuf., SafeCoat Durostain
4. S-W Minwax Water Based Stain
5. GP Woodpride Stain, 1700V

And Two Coats 1. Bona Kemi USA, Bona Tech Mega Waterbase Polyurethane
2. Target Coatings, Oxford Hybrid Satin Varnish
3. American Formulating & Manuf., Polyureseal BP
4. S-W Minwax Water Based Polyurethane
5. GP Woodpride WB Satin Polyurethane, 1802

Sand Between 220 grit sandpaper
Urethane Coats

6. Interior Concrete Masonry Units for Latex Semi-Gloss Finish in Dry Areas:

One Coat 1. PPG Speedhide Int/Ext Latex Block Filler (28g/l VOC formulation.)
2. S-W Loxon Block Surfacer
3. Glidden Professional Block Filler, 3010

And Two Coats 1. PPG Pure Performance Latex Semi-Gloss
2. S-W Harmony Latex Semi-Gloss
3. Glidden Professional Lifemaster No VOC S/G, 9200

D. Interior Paint Schedule for High Performance Coatings:

1. Interior Concrete Ceiling Surfaces for Acrylic - Semi-Gloss Finish in Dry Areas:

One Coat 1. Tnemec 151 Elasto-grip at 2.0 mils DFT
2. PPG PMC Amerlock Sealer at 1.0 mils DFT
3. Dupont High Solids Acrylic Primer at 2.0 mils DFT
4. International Intercryl 520 at 3.0 mils DFT
5. Devoe Coatings: Devflex 4020PF at 1.5 to 3 mils DFT

And Two Coats 1. Tnemec 28/29 Tufcryl at 2.0 –3.0 mils DFT per coat min.
2. PPG PMC Amercoat 220 at 3.0 mils DFT
3. Dupont High Solids Acrylic at 3.0 mils DFT
4. International Intercryl 530 at 3.0 mils DFT
5. Devoe Coatings: Devflex 4216 at 3.0 mils DFT

2. Interior Concrete Block, Epoxy/Urethane Coating:
(Surface Preparation: Cured, clean and dry, free of surface contaminants)

One Coat 1. Tnemec 130 Envirofil at 100 sqft/gal
2. PPG PMC Nu-Klad 114A at 100 sqft/gal
3. Dupont 25P at 100 sqft/gal
4. International Intercryl 320 at 80 sqft/gal

5. Devoe Coatings: Bloxfil 4000 at 100 sq. ft/gal
- And One Coat
 1. Tnemec 280 Tneme- glaze at 6.0 8.0 mils DFT
 2. PPG PMC Amercoat 133 6.0 to 8.0 mils DFT
 3. Dupont 100% Solids Epoxy at 7.0 to 9.0 mils DFT
 4. International InterH2O 735 at 8.0 to 10.0 mils DFT
 5. Devoe Coatings: Devran 724 at 4.0 to 6.0 mils DFT
- And One Coat:
 1. Tnemec 1080 Endura-Shield at 3.0 to 4.0 mils DFT
 2. PPG PMC Amercoat 335 at 3.0 to 4.0 mils DFT
 3. Dupont Imron WB Urethane at 3.0 to 4.0 mils DFT
 4. International Water Borne Urethane at 3.0 to 4.0 mils DFT
 5. Devoe Coatings Devthane 378H Urethane at 2.0 to 3.0 mils DFT
3. Interior Concrete Walls Exposed to View, Urethane Coating:
(Surface Preparation: Cured, clean and dry, free of surface contaminants)
 - One Coat
 1. Tnemec 201 Epoxoprime at 3.0- 4.0 mils DFT
 2. PPG PMC Amerlock Sealer at 3.0 to 4.5 mils DFT
 3. Dupont Hi-Solids Colar primer at 3.0 to 4.0 mils DFT
 4. International Interseal 670 HS at 3.0 to 4.0 mils DFT
 5. Glidden Professional Gripper Primer 3210 at 2.0 mils DFT
 - And One Coat
 1. Tnemec 280 Tneme-glaze at 6.0 to 8.0 mils DFT
 2. PPG PMC Amercoat 351 Epoxy at 6.0 to 8.0 mils DFT
 3. Dupont 100 % Solids Epoxy at 8.0-10.0 mils
 4. International Interseal 670 HS at 3.0 to 4.0 mils DFT
 5. Devoe Coatings Devran 224HS at 6.0 to 8.0 mils DFT
 - And One Coat
 1. Tnemec 297 Enviroshield WB at 3.0 to 3.5 mils DFT
 2. PPG PMC Amercoat 335 at 2.0 to 3.0 mils DFT
 3. Dupont WB Urethane at 3.5 to 4.0 mils DFT
 4. International Water Borne Urethane at 3.0 to 4.0 mils DFT
 5. Devoe Coatings Devthane 378H at 2.0 to 3.0 mils DFT
4. Interior Concrete Walls Exposed to View, Epoxy Coating for Non-Immersion Service:
(Surface preparation- Cured , clean ,dry and free of contaminants)
 - One Coat
 1. Tnemec 201 Epoxoprime at 2.0 to 3.0 mils DFT
 2. PPG PMC Amerlock Sealer at 1.0 to 1.5 mils DFT
 3. Dupont 25P Epoxy at 6.0 to 8.0 mils DFT
 4. RD Coatings Multiprim at 2.0 mils DFT
 5. International Interseal 670 HS at 3.0 to 4.0 mils DFT
 6. Glidden Professional Gripper Primer 3210 at 2.0 mils DFT
 - And One Coat
 1. Tnemec 280 Tneme-glaze at 6.0 to 8.0 mils DFT
 2. PPG PMC Amercoat 133 at 6.0 to 8.0 mils DFT
 3. Dupont 100% Solids Epoxy at 8.0 to 10.0 mils DFT
 4. RD Coatings Elasto Metal at 8.0 to 10.0 mils DFT
 5. International Interseal 670 HS at 3.0 to 4.0 mils DFT
 6. Devoe Coatings Devran 224HS at 6.0 to 8.0 mils DFT
 - And One Coat
 1. Tnemec 1080 Endura-Shield 2.0 to 3 mils DFT
 2. PPG PMC Amercoat 335 at 2.0 to 3.0 mils DFT
 3. Dupont WB Urethane at 3.0 to 4.0 mils DFT
 4. RD Coatings WB Urethane at 3.0 to 4.0 mils DFT

5. Devoe Coatings Devthane 378H at 2.0 to 3.0 mils DFT
5. Concrete Ceiling Coating –New or Previously Painted or Acoustical Plaster (Surface Preparation- Cured Clean and Dry)
- One Coat
1. Tnemec 151 Elasto-grip at 2.0 mils DFT
 2. International Intercryl 320 at 3.0 to 4.0 mils DFT
 3. Glidden Professional Bond Prep 3030 at 1.6 mils DFT
- And Two Coats
1. Tnemec 158 Biolastic at 8.0 mils DFT
 2. International Intercryl 320 at 3.0 to 4.0 mils DFT
 3. Devoe Coatings Devflex 4212 at 3.0 to 4.0 mils DFT
6. Interior Metals, Epoxy (Not specified to receive other coating systems/not shop finished):
- One Coat
1. Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer
- And One Coat
1. Tnemec N69 Epoxoline at 2.0 mils DFT
 2. PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT
 3. Dupont 25P at 3.0 to 4.0 mils DFT
 4. International Interseal 670 HS at 3.0 mils DFT
- And One Coat
1. Tnemec 29 Tufcryl at 2.0 to 3.0 mils DFT
 2. PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT
 3. Dupont High Solids Acrylic Coating 3.0 mils DFT
 4. International Intercryl 530 at 3.0 to 4.0 mils DFT
7. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated):
- One Coat
1. Tnemec 115 WB Unibond or 15 Unibond at 2.5 to 3.0 mils DFT
 2. PPG PMC Amercoat 220 Acrylic at 3.0 mils DFT
 3. International Intercryl 530 at 2.5 to 3.0 mils DFT
 4. S-W Waterborne Dry Fall at 3.0 to 4.5 mils DFT
8. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork: Same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 101100

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Markerboards.
 - 2. Tackboards.
 - 3. Marker wall coverings.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for custom wood trim for visual display surfaces.
 - 2. Section 099000 - PAINTING AND COATING for primers under marker wall covering.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples: For each type of visual display surface indicated, for units with factory-applied color finishes, and as follows:
 - 1. Actual sections of visual display surfaces.
- D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show location of panel joints.
 - 2. Show location of special-purpose graphics for visual display surfaces.
 - 3. Include sections of typical trim members.

- E. Maintenance Data: For visual display surfaces to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Design Professional. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display units vertically with packing materials between each unit.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

PART 2 - PRODUCTS

2.1 MARKERBOARD ASSEMBLIES

- A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021-inch-thick, porcelain-enamel face sheet.
 - 1. Available Manufacturers:
 - a. AACRO Products, Inc.
 - b. Best-Rite Manufacturing.
 - c. Claridge Products & Equipment, Inc.
 - d. Peter Pepper Products.
 - e. Steelcase Company; PolyVision products.
 - 2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing with binder containing no added urea formaldehyde.
 - 3. Fire Rating: ASTM E 84, Class A.
 - 4. Color: White, low gloss finish.

5. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.2 TACKBOARD ASSEMBLIES

- A. Linoleum Resilient Tackboard: Uni-color linoleum resilient homogeneous tackable surface consisting of linseed oil, granulated cork, rosin binders and dry pigments calendared onto a natural burlap backing with integral color throughout with surface-burning characteristics indicated.
 1. Available Manufacturers:
 - a. Forbo Industries; Bulletin Board.
 - b. WallTalkers; Tac-wall.
 2. Thickness: 1/4 inch.
 3. Fire Rating: ASTM E 84, Class A.
 4. Colors: Refer to Finish Schedule.

2.3 VISUAL DISPLAY WALL COVERINGS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. Best-Rite Manufacturing.
 2. Egan Visual Inc.
 3. Marsh Industries, Inc.; Visual Products Group.
 4. Omnova Solutions Inc.; Decorative Products; Commercial Wallcovering.
 5. WallTalkers; a division of RJF International Corporation.
- B. Visual Display Wall Covering: Intended for use with dry-erase markers and as a projection surface and consisting of [moderate-gloss, plastic film bonded to fabric backing; not less than 0.020-mil total thickness].
 1. Surface Graphics: 2-inch-square grid.
 2. Color: As selected by Architect from manufacturer's full range.
- C. Magnetic Visual Display Wall Covering: Intended for use with dry-erase markers and magnetic aids and consisting of moderate-gloss plastic film bonded to ferrous-powdered fabric backing; not less than 0.025-mil total thickness.
 1. Color: As selected by Architect from manufacturer's full range.
- D. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099000 - PAINTING AND COATING and recommended in writing by wall covering manufacturer for intended substrate.

2.4 ACCESSORIES

- A. Aluminum Frames and Trim: Factory-applied, fabricated from not less than 0.062-inch-thick, extruded aluminum; of size and shape indicated.
 1. Chalk/Marker Tray: Manufacturer's standard, continuous tray.
- B. Adhesive: Mildew-resistant, nonstaining adhesive, for use with specific visual display surfaces and substrate application, as recommended in writing by visual display surface manufacturer.

1. Adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FABRICATION

- A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.
- B. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
- C. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to neat, hairline closure.

2.6 ALUMINUM 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. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.
- B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

1. Join adjacent wall panels with concealed steel splines for smooth alignment.
2. Where markerboards abut, install with clean, trimless butt joints.

3.4 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION

SECTION 101400

SIGNAGE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. The Work of this Section includes, but is not limited to, the following:
 - 1. Room identification signs and directional signs.
 - 2. Exterior handicapped access signs.
 - 3. Metal building signs.
 - 4. Acid etched metal plaques.
 - 5. Interior signs for assisted listening devices.
 - 6. Interior signs for the occupancy posting of Assembly Spaces (Cafeteria, Gymnasium, Auditorium, Media Center). One sign shall be required at each exit doorway of each such space.
 - 7. Interior signage for new fire and smoke partitions.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. See Drawings for locations and details.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. Related work includes but is not limited to the following work covered in other sections:
 - 1. Project identification sign: Section 015000 – TEMPORARY FACILITIES AND CONTROLS.
 - 2. Gypsum wallboard construction: Section 092900 – GYPSUM BOARD ASSEMBLIES.
 - 3. Assisted listening device system: Section 260000 – ELECTRICAL
 - 4. Fire alarm annunciator panel and diagram of building: Section 260000– ELECTRICAL.

1.4 reference standards

- A. Massachusetts Architectural Access Board Guidelines.

1.5 PERFORMANCE REQUIREMENTS

- A. Marking and Identification for Fire- and Smoke-Partitions: New Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition- No less than two markings per wall of 15' or more in length, no less than one marking for walls less than 15' in length; and
 3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.
 4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.6 SUBMITTALS

- A. Submit Shop Drawings, samples and manufacturer's data in accordance with the requirements of Section 013300 - Submittals.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Submit Shop Drawings with complete dimensioned details and cuts of all items showing relationship and anchorage to surrounding construction. Include dimensioned templates and instructions for specialty items required to be built into the building.
- D. Schedules: Submit schedule of all room signs indicating type, text and graphics for each door or other location where a sign is required.
- E. Samples: Provide samples of manufacturers' colors of all prefinished items for color selection by the Architect. Furnish samples of all items requested by the Architect.
- F. Literature: Submit manufacturer's product data sheets, specifications and other published information for all items.

1.7 GUARANTEES AND WARRANTIES

- A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantees and warranties for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacture and Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Panel signs:
 - 1. ASI Sign Systems, Inc.
 - 2. Mohawk Sign Systems, Inc.
 - 3. SignWorks Graphics, Inc.
- B. Metal Plaques:
 - 1. Matthews International Corporation; Bronze Division.
 - 2. Metal Arts; Div. of L&H Mfg.
 - 3. The Southwell Company.
- C. Metal Building Signs:
 - 1. Beyond Signs, Inc.
 - 2. Lasermotion, Inc.
 - 3. SouthWood Corporation
- D. Basis-of-Design Product: The design for each sign is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified

2.2 MATERIALS

- A. Extruded Aluminum Bars, rods, Shapes and Tubes: ASTM B 221, 6063 alloy.
- B. Aluminum Sheet and Plate: ASTM B 209, alloy 1100, 3003 or 5052.
- C. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- D. Vinyl for die-cut letters: 3M Co., Schotchcal, or equal as provided by approved sign manufacturer. Vinyl shall have a matte finish with 0.003 to 0.006 inch film thickness.
- E. Cast Acrylic Sheet: Solid, clear acrylic sheet without surface imperfections.
 - 1. Material: Cast methyl methacrylate monomer plastic sheet.
 - 2. Flexural strength: Minimum 16,000 psi, per ASTM D 790
 - 3. Service temperature: 176° F minimum allowable continuous temperature.
 - 4. Product: Rohm and Haas, *Plexiglass G*, or equal as provided by approved sign manufacturer.

2.3 PANEL SIGNS

- A. Room Identification and Directional Signs, General:
 - 1. Locations: Provide one wall-mounted or doorframe-mounted room identification sign at each interior doorway and as follows. In addition, provide one sign at each of the following locations:
 - a. Each stair landing, denoting the floor level.
 - b. Elevator lobby on each floor.

- c. Each assisted listening system location.
 - d. Electric Rooms that are sprinklered.
 2. Locate signs where shown on Drawings and determined by the Architect.
 3. All signage shall be in conformance with the following:
 - a. Americans with Disabilities Act, "Accessibility Guidelines for Buildings and Facilities."
 - b. Regulations of the Massachusetts Architectural Access Board.
 4. Room Occupancy Signs: Provide room occupancy signs with text indicating maximum allowable occupancy of room, as determined by the Architect.
- B. Room Identification Sign Text and Graphics
 1. Letters and numerals: Identify each room by number designation and room name.
 - a. Height of letters and numerals: 5/8 inch.
 - b. Tactile relief: Raised 1/32".
 - c. Font: Upper case in sans-serif font style selected by the Architect.
 2. Braille: All text on signs shall be repeated in Grade 2 Braille.
 3. Symbols: Use internationally recognized symbols in compliance with ADA Accessibility Guidelines for the following locations: Rest rooms, stairs, elevators, Text Telephone..
- C. Directional Signs: Similar to Room Signs, with text and arrows.
 1. Quantity: 2
 2. Locations: To be determined.
- D. Mounting Accessories:
 1. Where feasible, mount signs using vandal/tamper resistant screws.
 2. Where screw mounting is not feasible provide double stick tape, only as approved by the Architect in writing.
 3. For signs to be mounted on glass, provide back plate of identical material and configuration to be mounted on reverse side of glass, to conceal mounting tape.
- E. Panel Sign Construction:
 1. Unframed Panel Sign Construction: All text and graphics shall be integral to panel material. Use manufacturer's highest quality sand-blast, photopolymer or other method that removes material from the panel surface to form text and graphics. Applied characters will not be accepted.
 - a. Panel Material for use with Sand-Blast Method: 1/8-inch (3 mm) thick high-pressure plastic laminate with melamine resin surface and phenolic resin core of contrasting colors.
 - b. Panel Material for use with Photopolymer Method: 1/8-inch (3 mm) thick homogeneous photopolymer. Provide high temperature cured polyester coating for raised text and graphics.
 - c. Edge condition: Square cut.
 - d. Colors: Provide multiple colors as selected by Architect from manufacturer's full range.
 - e. Finish: Non-glare matte acrylic finish.
 - f. Dimensions: 8 inches (203 mm) by 8 inches (203 mm).
 2. Product: Mohawk Sign Systems, Inc., *Graphic Process Series 200A – Sand Carved*, or equal by approved sign manufacturer.

2.4 EXTERIOR HANDICAPPED ACCESS SIGNS

- A. Handicapped Access Signs: Exterior grade stainless steel sign with circular border and black symbol on exposed stainless steel background, as selected by Architect.
 - 1. Material: Type 316 stainless steel with No. 4 finish.
 - 2. Dimensions: 8 inches x 8 inches (203 mm x 203 mm).
 - 3. Locations: At all exterior ground level doors and as shown on Drawings.

2.5 METAL BUILDING SIGNS

- A. Dimensional stainless steel signs with directional satin finish no. 4.
 - 1. Custom Signs:
 - a. Produce signs with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects.
 - b. Comply with requirements indicated for finish, style, and size.
 - c. Fabricate signs for concealed mounting.
 - 2. Mounting plate: Cast lugs into front of mounting plate and tap to receive threaded mounting screws.
 - 3. Fasteners:
 - a. Attachment to wall: Masonry anchors.
 - b. Provide attachment to substrate as shown on Drawings.
 - 4. Stainless Steel: Provide ASTM A 666, Type 316L.
 - 5. Character Style and Dimensions: As shown on Drawings.
 - 6. Locations: Exterior locations as shown on Drawings.
- B. Cast aluminum dimensional lettering with finish as selected by Architect from manufacturers full range.
 - 1. Custom Signs:
 - a. Produce signs with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects.
 - b. Comply with requirements indicated for finish, style, and size.
 - c. Fabricate signs for concealed mounting.
 - 2. Mounting plate: Cast lugs into front of mounting plate and tap to receive threaded mounting screws.
 - 3. Fasteners:
 - a. Attachment to wall: Masonry anchors.
 - b. Provide attachment to substrate as shown on Drawings.
 - 4. Character Style and Dimensions: As shown on Drawings.
 - 5. Locations: Interior locations as shown on Drawings.

2.6 METAL PLAQUES

- A. Dedication Plaques:
 - 1. General: Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy
 - 2. Dimensions and Configuration: One (1) plaques at 24 inches wide by 36 inches tall, refer to drawings.
 - 3. Location: As selected by Architect.
 - 4. Thickness: Not less than 3/8 inch (9 mm).
 - 5. Material: Acid etched, stainless steel.
 - 6. Letters: Typeface selected by Architect.
 - 7. Text: Layout and design, including border, will be provided by Architect.

8. Finish:
 - a. Raised areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin finish.
 - b. Background finish: Painted.
9. Metal plaques shall be installed by means of concealed, vandal-resistant fastening method at interior location selected by Architect.

- B. Round Plaques:
1. Provide stainless steel plaques similar to above with etched graphics.
 2. Refer to architectural drawings.
 3. Quantity: 15.
 4. Size: 8" Diameter

2.7 IDENTIFICATION LABELS FOR FIRE AND SMOKE PARTITIONS

- A. Identification Labels: 4 by 12 inches, vinyl adhesive signs, equal to No. E10412, by Safety Supply Warehouse.
1. Text: "FIRE AND SMOKE BARRIER PROTECT ALL OPENINGS"

2.8 ACCESSORIES

- A. Mounting Methods: Use exposed, vandal-proof fasteners or silicone adhesive formulated for compatibility with sign material and mounting surface

PART 3 - EXECUTION

3.1 GENERAL

- A. Install specialty items in strict accordance with the approved Shop Drawings and the manufacturer's installation instructions.
- B. Signage: Signs shall be installed plumb, level, clean and neat, subject to Architect's approval. Lettering of structural steel will be done under Section 051200 – Structural Steel.
- C. Except as otherwise required, remove stickers and labels from all items, clean and polish all bright metal work, clean factory-painted surfaces, and leave all surfaces free from dirt, smudges, abrasions, scratches and other visual defects.
- D. Promptly remove all packing materials and debris, caused by the work of this Section from the site, and legally dispose of same.

3.2 INSTALLATION OF PANEL SIGNS

- A. Mechanical Mounting: Wherever possible, mount panel signs and directories using exposed, vandal-proof fasteners.
- B. Silicone-Adhesive Mounting: Use liquid-silicone adhesive recommended in writing by sign manufacturer to attach signs to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended in writing by sign manufacturer to hold sign in place until adhesive has

fully cured.

3.3 INSTALLATION OF EXTERIOR BUILDING SIGNS

- A. Mount signs using standard fastening methods recommended in writing by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish sign spacing and to locate holes for fasteners

3.4 INSTALLATION OF CAST METAL PLAQUES

- A. Cast-Metal Plaques: Mount plaques using standard concealed fastening methods recommended in writing by manufacturer for type of wall surface indicated.
- B. Concealed Mounting: Mount plaques by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

3.5 INSTALLATION OF IDENTIFICATION FOR FIRE AND SMOKE PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.6 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION

SECTION 102110
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 1 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Solid plastic toilet compartments and screens, floor-mounted and overhead braced.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 102800 - TOILET ACCESSORIES for partition mounted accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
- D. Samples for Verification: Of each type of color and finish required for units, prepared on 6-inch-square Samples of same thickness and material indicated for Work.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating toilet compartments without field measurements. Coordinate wall, floor, ceilings, and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 RECYCLED PLASTIC UNITS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Accurate Partitions Corporation.
 2. Bradley Corporation; Mills Partitions.
 3. General Partitions Mfg. Corp.
 4. Global Partitions.
 5. Scranton Products (Capitol, Comtec, and Santana)
 6. Yemm & Hart Ltd.
- B. Door, Panel, and Pilaster Construction: Solid, recycled high-density polyethylene (HDPE) material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
 1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range of colors and patterns.
- C. Brackets and Fittings: Manufacturer's standard design.
 1. Full-Height (Continuous) Type Brackets: Stainless steel.
 2. Pilaster Shoes and Sleeves (Caps): Stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.

2.2 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
 1. Material: Stainless steel.
 2. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

- A. Floor-Mounted, 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-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 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: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - B. Floor-Mounted, Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches 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. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.
 - D. Wall-Hung Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION

SECTION 102120

CUBICLES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Curtain tracks and curtain carriers.
 - 2. Cubicle curtains.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking for mounting items requiring anchorage.

1.3 PERFORMANCE REQUIREMENTS

- A. Curtains: Provide curtain fabrics with the following characteristics:
 - 1. Fabrics are launderable to a temperature of not less than 160 deg F.
 - 2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

- A. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
 - 1. Include data on each type of applied curtain treatment.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

- C. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
 - 1. Include details on blocking.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
- E. Samples for Initial Selection: For each type of curtain material indicated.
- F. Samples for Verification: For each type of product required, prepared on Samples of size indicated below.
 - 1. Curtain Fabric: 12-inch-square swatch or larger as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
 - 2. Mesh Top: Not less than 4 inches square.
 - 3. Curtain Track: Not less than 4 inches long.
 - 4. Curtain Carrier: Full-size unit.
- G. Curtain and Track Schedule: Use same designations indicated on Drawings.
- H. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.
- I. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install cubicles 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.

PART 2 - PRODUCTS

2.1 CURTAIN TRACKS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Crowder, K. N. Manufacturing, Inc.

2. General Cubicle Company, Inc.
3. InPro Corporation.
4. Nelson, A. R. Co.
5. Silent Gliss USA Inc.

B. Extruded-Aluminum Track: Not less than 1-1/4 inches wide by 3/4 inch high; with minimum wall thickness of 0.062 inch.

1. Finish: Satin anodized.

C. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.

D. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.

E. Exposed Fasteners: Stainless steel.

F. Concealed Fasteners: Stainless steel.

2.2 CURTAINS

A. Cubicle Curtain Fabric: Curtain manufacturer's standard, 100 percent polyester, inherently and permanently flame resistant, stain resistant, and antimicrobial.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. KoSa; Avora FR.
- b. Trevira, R-M Schulz Consulting, Inc.; Trevira CS.

2. Pattern: As selected by the Architect.
3. Color: As selected by Architect.

B. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.

C. Mesh Top: No. [50] [40] [42] nylon mesh.

D. Curtain Tieback: Nickel-plated brass chain; one at each curtain termination.

2.3 CURTAIN FABRICATION

A. Fabricate curtains to comply with the following requirements:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: Equal to floor-to-ceiling height, with 20-inch mesh top, and minus distance above the finished floor at bottom as follows:
 - a. Cubicle Curtains: 12 inches.

B. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install tracks level and plumb, according to manufacturer's written instructions.
- B. Provide track fabricated from 1 continuous length.
 - 1. Curtain Track Mounting: As indicated on Drawings.
- C. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
 - 1. Provide one locking switch unit for each pair of beds.
 - 2. Provide one hinged loading unit for each bed.
- D. Curtain Carriers: Provide curtain carriers adequate for 6-inch (152-mm) spacing along full length of curtain plus an additional carrier.
- E. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

3.3 PROTECTION

- A. Protect installed recessed track openings with nonresidue adhesive tape to prevent construction debris from impeding carrier operation. Remove tape prior to Substantial Completion.

END OF SECTION

SECTION 102210

WIRE MESH PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. Wire mesh fabrications for the following applications:
 - a. Standard-duty interior partitions.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

- 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 055100 - METAL STAIRS AND RAILINGS for railing systems requiring wire mesh railing insert panels.
- 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wire mesh items.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: 12-by-12-inch panel constructed of specified frame members and wire mesh. Show method of finishing members at intersections.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wire mesh items crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of construction contiguous with wire mesh items by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish location dimensions and proceed with fabricating wire mesh items without field measurements. Coordinate with adjacent construction to ensure that actual location dimensions correspond to established dimensions.

1.6 COORDINATION

- A. Coordinate installation of anchorages for wire mesh items supported or anchored to permanent construction. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Acorn Wire & Iron Works, Inc.
 2. Jesco Industries, Inc.
 3. King Wire Partitions, Inc.
 4. Miller Wire Works, Inc.
 5. Standard Wire & Steel Works.
 6. Wire Crafters, Inc.

2.2 MATERIALS

- A. Steel Wire: ASTM A 510.
- B. Steel Plates, Channels, Angles, and Bars: ASTM A 36/A 36M.
- C. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- D. Steel Pipe: ASTM A 53/A 53M, Schedule 40, unless another weight is indicated or required by structural loads.
- E. Square Steel Tubing: Cold-formed structural-steel tubing, ASTM A 500.
- F. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with G60 (Z180) zinc (galvanized) or A60 (ZF180) zinc-iron-alloy (galvannealed) coating designation.
- G. Panel-to-Panel Fasteners: Manufacturer's standard steel bolts.
- H. Postinstalled Expansion Anchors in Concrete: With capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.
- I. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated and fabricated from corrosion-resistant materials; with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by wire mesh construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

2.3 PAINT

- A. Shop Primers: Provide primers to comply with applicable requirements in Section 099000 - PAINTING AND COATING.

2.4 STANDARD-DUTY WIRE MESH PARTITIONS

- A. Mesh: 0.135-inch-diameter, intermediate-crimp steel wire woven into 1-1/2-inch diamond mesh.
- B. Vertical Panel Framing: 1-1/4-by-5/8-by-0.0966-inch cold-rolled, C-shaped steel channels with 1/4-inch- (6-mm-) diameter bolt holes spaced not more than 18 inches o.c. along center of framing.
- C. Horizontal Panel Framing: 1-by-1/2-by-1/8-inch cold-rolled steel channels.
- D. Horizontal Panel Stiffeners: 1-by-1/2-by-1/8-inch cold-rolled steel channels with wire woven through, or two 1-by-3/8-by-1/8-inch cold-rolled steel channels bolted or riveted toe to toe through mesh.
- E. Top Capping Bars: 2-1/4-by-1-inch cold-rolled steel channels.
- F. Posts for 90-Degree Corners: 1-1/4-by-1-1/4-by-1/8-inch steel angles with 1/4-inch- diameter bolt holes aligning with bolt holes in vertical framing; with floor anchor clips.
- G. Posts for Other-Than-90-Degree Corners: Manufacturer's standard steel pipe or tubing with 1/4-inch- diameter bolt holes aligning with bolt holes in vertical framing.
- H. Floor Shoes: Steel, cast iron, or cast aluminum, 2 inches (50 mm) high; sized to suit vertical framing, drilled for attachment to floor, and with set screws for leveling adjustment.
- I. Swinging Doors: Fabricated from same mesh as partitions, with framing fabricated from 1-1/4-by-1/2-by-1/8-inch steel channels or C-channels, banded with 1-1/4-by-1/8-inch flat steel bar cover plates on 3 sides, and with 1/8-inch-thick angle strike bar and cover on strike jamb.
 - 1. Hinges: Full-surface type, 3-by-3-inch steel, 1-1/2 pairs per door; bolted, riveted, or welded to door and jamb framing.
 - 2. Cylinder Lock: Mortise type with cylinder specified in Section 087100 - DOOR HARDWARE operated by key outside and recessed knob inside.
- J. Accessories:
 - 1. Sheet Metal Base: 0.0598-inch- thick, cold-rolled steel sheet.
 - 2. Adjustable Filler Panels: 0.0598-inch- thick, cold-rolled steel sheet; capable of filling openings from 2 to 12 inches.
 - 3. Wall Clips: Manufacturer's standard, cold-rolled steel sheet.
- K. Finishes for Interior Locations: Powder-coated finish, color as selected.

2.5 WIRE MESH CEILINGS

- A. Mesh, Framing, and Stiffeners: Fabricated from same mesh and framing as wire mesh partition panels.
- B. Perimeter Partition Supports: 1-1/2-by-1-1/2-by-1/8-inch steel angle, with 1/4-inch-diameter bolt holes aligned for bolting to top of wire mesh partitions and to sides of wire mesh ceiling panels.

- C. Wall Supports: 1-1/2-by-1-1/2-by-1/8-inch steel angle punched for attachment to wall and wire mesh ceiling panels.
- D. Intermediate Supports: Steel I-beam, as recommended by manufacturer.
- E. Intermediate Support Posts: 2-by-2-by-1/8-inch steel pipe or tubing.
- F. Finishes: Match adjacent wire mesh partitions.

2.6 FABRICATION

- A. General: Fabricate wire mesh items from components of sizes not less than those indicated. Use larger-size components as recommended by wire mesh item manufacturer. Provide bolts, hardware, and accessories as required for complete installation.
 - 1. Fabricate wire mesh items to be readily disassembled.
 - 2. Welding: Weld corner joints of framing and grind smooth.
- B. Standard Duty Wire Mesh Partitions: Fabricate wire mesh partitions with cutouts for pipes, ducts, beams, and other items indicated. Finish edges of cutouts to provide a neat, protective edge.
 - 1. Mesh: Securely clinch mesh to framing.
 - 2. Framing: Fabricate framing with mortise and tenon corner construction.
 - a. Provide horizontal stiffeners as indicated or, if not indicated, as required by panel height and as recommended by wire mesh partition manufacturer. Weld horizontal stiffeners to vertical framing.
 - b. Fabricate partition and door framing with slotted holes for connecting adjacent panels.
 - 3. Fabricate wire mesh partitions with 3 inches of clear space between finished floor and bottom horizontal framing.
 - 4. Doors: Align bottom of door with bottom of adjacent panels.
 - a. For doors that do not extend full height of partition, provide transom over door, fabricated from same mesh and framing as partition panels.
 - 5. Hardware Preparation: Mortise, reinforce, drill, and tap doors and framing as required to install hardware.

2.7 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Finish wire mesh items after assembly.
 - 2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

- B. Powder-Coated Finish: Apply manufacturer's standard baked finish, complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine floors for suitable conditions where wire mesh items will be installed.
- C. Examine walls to which wire mesh items will be attached for properly located blocking, grounds, and other solid backing for attachment of support fasteners.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Wire Mesh Partitions:

1. Anchor wire mesh partitions to floor with 3/8-inch-diameter, postinstalled expansion anchors at 12 inches o.c. through anchor clips located at each post and corner. Shim anchor clips as required to achieve level and plumb installation.
2. Anchor wire mesh partitions to walls at 12 inches o.c. through back corner panel framing.
3. Secure top capping bars to top framing channels with 1/4-inch-diameter "U" bolts spaced not more than 28 inches o.c.
4. Provide line posts at locations indicated.
5. Where standard-width wire mesh partition panels do not fill entire length of run, provide adjustable filler panels to fill openings.
6. Install doors complete with door hardware.
7. Install security windows complete with window hardware.
8. Weld or bolt sheet metal bases.
9. Bolt accessories to wire mesh partition framing.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors to operate easily without binding.
- B. Check and readjust operating hardware items just before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work including doors and framing that are warped, bowed, or otherwise unacceptable.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint; paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION

SECTION 102220

FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Manually-operated, single-panel partitions.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for framing and supports.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Provide operable panel partitions capable of withstanding the effects of earthquake motions determined according to Code requirements.
- B. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
 - 1. Sound Transmission Requirements: Operable panel partition assembly tested in a full-scale opening, 14 by 9 feet for laboratory sound transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Indicate storage and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 1. Suspended ceiling components.
 2. Structural members to which suspension systems will be attached.
 3. Size and location of initial access modules for acoustical tile.
 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - E. Setting Drawings: For embedded items and cutouts required in other work, including support-beam punching template.
 - F. Samples for Verification: For each type of finish, covering, or facing indicated, prepared on Samples of size indicated below.
 1. Applied Facing: Full width by not less than 8-inch-long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
 - G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each operable panel partition.
 - H. Maintenance Data: For operable panel partitions to include in maintenance manuals.
 1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 2. Seals, hardware, track, carriers, and other operating components.
 - I. Warranty: Special warranty specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
 - B. Fire-Test-Response Characteristics: Provide operable panel partitions with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: 450 or less.
 - C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify operable panel partition openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal wear.
- 2. Panel Warranty Period: Two years from date of Substantial Completion.
- 3. Track Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Advanced Equipment Corporation.
 - 2. Hufcor.
 - 3. Modernfold, Inc.
- B. Basis of Design: Series 931 as manufactured by Modernfold, Inc.; or approved equal.

2.2 MATERIALS

- A. Steel Frame: Steel sheet, manufacturer's standard nominal specified thickness for uncoated steel.
- B. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard thickness.
- C. Gypsum Board: ASTM C 1396.

2.3 OPERABLE PANELS

- A. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

- B. Dimensions: Fabricate operable panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
- C. STC: Not less than 50.
- D. Panel Closure: Manufacturer's standard.
- E. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

2.4 SEALS

- A. General: Provide types of acoustical seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:
 - 1. Manufacturer's standard seals.
 - 2. Seals made from materials and in profiles that minimize sound leakage.
 - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.
- B. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous PVC acoustical seal.
- C. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
 - 1. Automatically Operated: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 2-inches between retracted seal and floor finish.

2.5 FINISH FACING

- A. General: Provide finish facings that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
- B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-B for type indicated; Class A.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.6 SUSPENSION SYSTEMS

- A. Suspension Tracks: Steel or aluminum adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish, unless otherwise indicated.
- E. Steel Finish: Factory-applied, corrosion-resistant, protective coating, unless otherwise indicated.

2.7 ACCESSORIES

- A. Storage Pocket Door: Full height at end of partition runs to conceal stacked partition; of same materials, finish, construction, thickness, and acoustical qualities as panels; complete with operating hardware and acoustical seals at soffit, floor, and jambs. Hinges in finish to match other exposed hardware.
 - 1. Manufacturer's standard method to secure pocket door in closed position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with operable panel partition manufacturer's written installation instructions.
- B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.3 ADJUSTING

- A. Adjust operable panel partitions to operate smoothly, without warping or binding. Lubricate hardware, electric operator, and other moving parts.
- B. Adjust pass doors and pocket doors to operate smoothly and easily, without binding or warping. Check and readjust operating hardware. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.4 FIELD QUALITY CONTROL

- A. Light Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids; adjust partitions for acceptable fit.

- B. NIC Testing: The Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- C. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than the NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
- D. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.
- E. Repair or replace operable panel partitions within areas where test results indicate partitions do not comply with requirements, and retest partitions.
- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of repaired, replaced, or additional work with specified requirements.

3.5 CLEANING

- A. Clean soiled surfaces of operable panel partitions to remove dust, loose fibers, fingerprints, adhesives, and other foreign materials according to manufacturer's written instructions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner Project Manager's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION

SECTION 102600

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Corner guards.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS.
 - 2. Section 087100 - DOOR HARDWARE for metal armor, kick, mop, and push plates.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Corner Guards: 12 inches long.
- D. 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.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- B. 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 Division 01 Sections.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.5 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.

1.6 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 240/A 240M.
- B. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- C. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.
- D. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- E. 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. Contact Adhesive: 80 g/L.
3. Special Purpose Contact Adhesive: 250 g/L.

2.2 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated from 1-piece, formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ARDEN Architectural Specialties, Inc.
 - b. Balco, Inc.
 - c. Boston Retail Products.
 - d. Construction Specialties, Inc.
 - e. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - f. Korogard Wall Protection Systems; Division of RJF International Corporation.
 - g. Pawling Corporation.
 2. Material: Stainless steel, Type 304.
 - a. Thickness: Minimum 0.0781 inch.
 - b. Finish: Directional satin, No. 4.
 3. Wing Size: Nominal 3-1/2 by 3-1/2 inches.
 4. Corner Radius: 1/8 inch.
 5. Mounting: Flat-head, countersunk screws through factory-drilled mounting holes.

2.3 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.

2.4 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, 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. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.5 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, polished finish indicated, free of cross scratches.
 - 1. Run grain of directionally textured finishes with long dimension of each piece.
- C. Directional Satin Finish: No. 4 finish.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 INSTALLATION

- A. 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. Provide mounting hardware, anchors, and other accessories required for a complete installation.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

END OF SECTION

SECTION 102800
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for requirements that affect work under this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. Products furnished and installed under this Section:
 - 1. Provide toilet accessories as scheduled herein in Part 2 for installation under this section.
 - 2. Coordinate and provide recesses and openings for Owner provided toilet accessories.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
- C. Related work includes but is not limited to the following work covered in other sections:
 - 1. Wood blocking for wall-mounted accessories including Owner provided toilet accessories: Section 061000 – ROUGH CARPENTRY.
 - 2. Openings for recessed accessories and additional blocking in gypsum wallboard construction: Section 092900 – GYPSUM BOARD ASSEMBLIES.
 - 3. Plumbing fixtures and fittings: Section 220000 – PLUMBING.
 - 4. Connection to electric hand dryer: Section 260000 – ELECTRICAL.

1.3 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300– SUBMITTAL PROCEDURES.
- B. Product Data: For each material and manufactured product specified.

- C. Shop Drawings: Show details and methods of attachment to adjacent materials. Provide templates for work by other trades.
- D. Samples: Submit samples of all materials requested by Architect for approval.
- E. Schedule: Submit complete accessory schedule indicating types, quantities and model numbers of accessories for each room in which accessories will be installed.
- F. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
 - 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018113.
 - 2. Show installed costs for all items listed.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Where possible, obtain all toilet accessories from a single manufacturer with resources to provide materials of consistent quality in appearance without delaying the work.

1.5 SHIPPING AND HANDLING

- A. Packing and Labeling:
 - 1. Accessories shall be carefully packed in containers, complete with required fastenings and miscellaneous devices required for attachment.
 - 2. Mirrors shall be factory labeled and the labels shall not be removed until installation has been approved by Architect.

1.6 GUARANTEES

- A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturer shall provide his standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities that manufacturers and Contractor may have by law or by other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. General Toilet Accessories:
 - a. American Specialties, Inc.
 - b. Bobrick Washroom Equipment, Inc.
 - c. General Accessory Manufacturing Co.

d. Approved equal.

- B. Basis of Design: Products below are designated in terms of names of products manufactured by Bobrick Washroom Equipment, Inc. Contura Series, to establish the general character and materials required for toilet accessories for this project. Equivalent products by acceptable manufacturers will be approved.

2.2 MATERIALS

- A. Stainless Steel Sheets and Plates: Type 304 with No. 4 finish in conformance with ASTM A666, unless otherwise noted.
- B. Chromium plating: Nickel plus chromium electrodeposited on base metal; Service Condition Number SC-2 in conformance with ASTM B 456.
- C. Galvanized Steel: Hot-dipped galvanized to level G60 (Z180) in conformance with ASTM A 653/A 653M.
- D. Mirror Glass: 1/4" clear polished plate glass, Type 1, Class 1 Quality q2 in conformance with ASTM C 1036. Mirrors shall have a silver coating hermetically sealed with a uniform coating of electrolytic copper plating. The copper shall be protected by a coat of mineral oxide, oil-base paint. Mirrors shall be guaranteed for a period of not less than ten years against silver spoilage.
- E. Fastening Devices: Anchors, screws, bolts, expansion shields and plates shall be concealed wherever possible. All exposed hardware shall match the finish of the surface in which attached. All concealed steel hardware shall be galvanized. All fasteners shall be theft-proof. All exposed screws shall have Phillips heads.
- F. Finishes: Unless otherwise indicated, finish of all metal accessories shall be No. 4 satin stainless steel (US32D).

2.3 TOILET ACCESSORIES, GENERAL

- A. Quantities: Furnish one (1) of each accessory for each toilet room and toilet room compartment, unless otherwise indicated.
- B. Manufacturer's name shall not be visible on installed accessories except as otherwise approved by Architect.
- C. Furnish all fishplates, bolts, screws, lags, reinforcement and all other fastenings and accessories required to complete installation, whether such items are shown on Drawings, specified, or included in the manufacturer's catalogue descriptions, or not. Furnish and deliver to drywall installer concealed reinforcement for grab bars in stud partitions as required to effectively transfer horizontal pulling loads to at least two studs on each side of each flange, Bobrick 2562 Series, or equal. Where grab bars are attached to masonry, provide reinforcement to mason for building in.
- D. Locks: Where lockable units are required, they shall be keyed alike. Provide at least two keys per lock.

2.4 GENERAL TOILET ACCESSORY SCHEDULE

- A. General: The following accessories and model numbers are based on Bobrick, Contura Series (unless indicated otherwise). Equal products from approved manufacturers will be accepted.
- B. Surface Mounted Soap Dish: B-6807.
- C. Extra-Heavy-Duty Shower Curtain Rod: B-6047.
- D. Stainless Steel Shower Curtain Hook: 204-1.
- E. Vinyl Shower Curtains: 204-2 and 204-3.
- F. Reversible Solid Phenolic Folding Shower Seats: Wall mounted, ADA compliant: B-5181.
- G. Recessed Napkin/Tampon Vendor: B-4706 Series.
- H. Partition-Mounted Sanitary Napkin Disposal: B-4354.
- I. Surface-Mounted Sanitary Napkin Disposal: B-270.
- J. Recessed Waste Receptacle: B-43644.
- K. Stainless Steel Shelf at shower stalls at girls and women's toilet rooms, length of mirror: B-295.
- L. Frameless Mirror as specified above under Materials Article: Provide concealed wall hangers for attachment.

2.5 GRAB BARS

- A. Adult Grab Bars [GB]:
 - 1. Description: 1-1/4 inches o.d. concealed mounting.
 - 2. Construction: 18 gauge 304 stainless steel bars with polished ends; bars shall be heliarc welded to flange 1/2" thick and 3" in diameter.
 - a. Finish: Satin finish with peened gripping surface.
 - b. Mounting: Attachment devices and reinforcing adequate to accept 300 pound concentrated load at each attachment point without failure and 250 pounds total load for 5 minutes without displacement of bar. Screw holes shall be recessed and screws shall be of vandal-resistant design.
 - 3. Configurations: At all locations, bar shall be 1-1/2 inches from wall.
 - a. Typical: 36 inches (914 mm) and 42 inches (1.07 m) long unless noted otherwise.
 - 4. Locations: Multiple-user and single-user toilet rooms, except for those used by pupils in Kindergarten and Pre-kindergarten classrooms.
 - 5. Product: Bobrick Washroom Equipment, Inc., *B-5806.99-series*, or equal by approved manufacturer.

2.6 ACCESSORIES FOR CUSTODIAL CLOSETS

- A. Broom Holder [BH]:
 - 1. Description: Stainless steel mounting strip with 3 mop holders.

- a. Mop holders: Anti-slip holder with spring-loaded rubber cam designed to grip handles 7/8" to 1-1/4" in diameter.
2. Locations: One (1) at each custodial closet
3. Product: Bobrick Washroom Equipment, Inc., B-223, or equal by approved manufacturer.

2.7 BABY CHANGING STATION

- A. Material: 18 gauge, type 304 satin stainless steel exterior finish with high density grey polyethylene interior.
- B. Features: Nylon safety straps, bag hooks, safety instructions, pneumatic cylinder, concealed hinges, and liner dispenser.
- C. Product: Bobrick Washroom Equipment, Inc., KB110-SSRE, Recessed-Mounted Satin Stainless Steel Finish Baby Changing Station, or approved equal.

2.8 ELECTRIC HAND DRYERS

- A. Provide electric hand dryers equal to Excel Dryer, Xlerator, Model XL-SB, or approved equal.
- B. Voltage: 208, single phase.

PART 3 - EXECUTION

3.1 INSTALLATION OF ACCESSORIES

- A. Coordinate installation of blocking and partition construction with mounting requirements for toilet accessories. Provide recesses in walls for recessed units, including Owner provided toilet accessories.
- B. Install toilet accessories in accordance with manufacturer's written installation instructions.
- C. Include all fastening and attachment devices suitable for surface to which accessory will be applied. Determine the weight, live loading and other characteristics of each item as well as the particular wall, ceiling or floor construction that each item will be secured to and include all costs of attachment devices in connection therewith. Be responsible for the safety and adequacy of all fasteners, accessories and supplementary reinforcing.
- D. Height, location and placement of all accessories shall be as shown on Drawings and as directed by the Architect. Where exact locations for accessories are not indicated on the Drawings, they shall be established, both vertically and horizontally, by the Architect. Obtain Architect's determination before installing any fixtures not specifically located on the Drawings.
- E. Installation shall be performed only by mechanics skilled in this type of work, and in accordance with the manufacturer's printed directions or recommendations. Erect all items level, plumb, true and in alignment. Conceal all evidence of drilling, cutting or patching of substrate. Expansion anchors shall be metal type. Do not use wood plugs.
- F. Submit proper templates, setting diagrams and other information as required to other trades as required, to accommodate the proper cutting and fitting of such items to receive the required toilet

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room accessories.

- G. Coordinate connection of electric hand dryers with electrical contractor.

END OF SECTION

SECTION 104100

EMERGENCY ACCESS AND INFORMATION CABINETS

PART 1 GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. Fire department key vault box.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

- 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- H. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Section 042000 – UNIT MASONRY.
 - 2. Section 061000 - ROUGH CARPENTRY; Wood blocking.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, installation instructions, use limitations and recommendations for each product and system used. Provide manufacturer's certifications stating that products and systems comply with requirements.

- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

- C. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work. Provide plans, elevations, and details of anchorage, connections and accessory items. Provide installation templates for work installed by others.

- D. Contractor's Review: Before commencing work, submit signed statement that Contract Documents have been reviewed with a qualified representative of supplier/manufacturer, and that selected materials and construction are proper, compatible, and adequate for application shown.

PART 2 PRODUCTS

2.1 FIRE DEPARTMENT KNOX BOX KEY (VAULT) CABINET

- A. Provide Knox Box Key (Vault) Cabinet at building entrance; location shall be acceptable to local Fire Department.
- B. Basis of Design: Model 3200 Knox-Box, Recessed Mounted Type, by Knox Company, Phoenix, AZ 85027; www.knoxbox.com
 - 1. Finish: Weather resistant TGIC polyester powder coat, color as selected by Architect from manufacturer's standard colors.
 - 2. Locking: Provide lock and keys acceptable to local Fire Department.
 - 3. Building Alarm Interface: Provide tamper switch interface with building alarm system.
 - 4. Accessories:
 - a. Provide manufacturer's standard recessed mounting kit, for installation in specified construction.
 - b. Provide alarm tamper switches, UL listed.

PART 3 EXECUTION

3.1 INSPECTION

- A. Rough-In Work: Examine installation of walls and other conditions under which work is to be installed; verify dimensions of services and substrates before fabricating work.
- B. Notify Contractor of unsatisfactory locations and dimensions of other work and of unsatisfactory conditions for proper installation of equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected in manner satisfactory to Installer.

3.2 FIRE DEPARTMENT KNOX BOX INSTALLATION

- A. General: Set each item of equipment securely in place, level, and adjust to correct height (4 ft. - 0 in. AFF).
- B. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorage where possible. Seal perimeter joints in accordance with Section 079200 - JOINT SEALANTS.

3.3 CLEANING

- A. After completion of installation and other major work remove protective coverings, if any, and clean equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed-metal surfaces and touch-up painted surfaces. Replace work that cannot be successfully restored.

END OF SECTION

SECTION 104400

FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Portable fire extinguishers.
 - 2. Fire-protection cabinets for portable fire extinguishers.
 - 3. Mounting brackets for fire extinguishers.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 099000 - PAINTING AND COATING for field painting fire-protection cabinets.
 - 2. Division 21 - FIRE PROTECTION for fire hose valves and standpipes.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.
 - 1. Fire Extinguishers: Include rating and classification.
 - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Maintenance Data: For fire extinguishers and fire-protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 2-A:10-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.2 FIRE-PROTECTION CABINET

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. JL Industries, Inc.
 - 2. Larsen's Manufacturing Company.
 - 3. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Type: Suitable for fire extinguisher.
- C. Cabinet Material: Enameled-steel sheet.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Trimless with Plaster Stop: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as plaster stop. If wall condition does not allow for trimless with plaster stop, provide flat 5/16 inch trim of same material as the cabinet box.
- E. Semirecessed 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. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

- F. Door Material: Steel sheet with baked enamel finish, color as selected.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered **break** glass.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- J. 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. **Break-Glass Strike: Manufacturer's standard metal strike, complete with chain and mounting clip, secured to cabinet, or provide locking mechanism that allows for emergency access to the cabinet without the breaking of glass, simply by pulling sharply on the cabinet's handle.**
 - 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

2.4 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. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.
 - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 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. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.
 - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply vinyl lettering at locations indicated.

3.4 INSTALLATION OF FIRE-RATED CABINETS

- A. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
- B. Seal through penetrations with firestopping sealant as specified in Section 078410 - PENETRATION FIRESTOPPING.

3.5 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties 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 manufacturer.
- 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

SECTION 105110

METAL LOCKERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Metal athletic lockers.
 - 2. Locker benches.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for furring, blocking, and shims required for installing metal lockers and concealed within other construction before metal locker installation.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show base, top, trim and other accessories.
 - 2. Include locker identification system.
- D. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.
- C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board requirements and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:
 - 1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
 - 2. Recessed openings.
 - 3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate size and location of bases for metal lockers.
- B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ALL-WELDED ATHLETIC METAL LOCKERS

- A. Available Manufacturers:
 - 1. All-Welded, Athletic Metal Lockers:
 - a. Penco Products, Inc., Subsidiary of Vesper Corporation; All-Welded Lockers.
 - b. Republic Storage Systems Company; All-Welded Ventilated Lockers.
- B. Locker Arrangement: Three-tier.

- C. Body: Assembled by welding riveting or bolting body components together. Fabricate from unperforated, cold-rolled steel sheet with thicknesses as follows:
 - 1. Tops and Bottoms: 0.0528 inch thick, with single bend at edges.
 - 2. Backs: 0.0428 inch thick.
 - 3. Shelves: 0.0528 inch thick, with double bend at front and right-angle single bend at sides and back.
- D. Frames: Channel formed; fabricated from 0.0528-inch-thick, cold-rolled steel sheet or 0.0966-inch-thick steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
- E. Locker Base: Structural channels, formed from 0.0528-inch-thick, cold-rolled steel sheet; welded to front and rear of side-panel frames.
- F. Perforated Doors: One-piece, fabricated from 0.0677-inch-thick, cold-rolled steel sheet with manufacturer's standard diamond perforations; formed into channel shape with double bends.
 - 1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
- G. Hinges: Self-closing; welded to door and attached to door frame with not less than 2 factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.
- H. Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry resistant.
 - 1. Single-Point Latching: Nonmoving latch hook. Equip each door with 1 latch hook, fabricated from minimum 0.1116-inch-thick steel; welded midway up full-height door strike; with resilient silencer.
- I. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latch mechanism that consists of steel rods or bars that engage main locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.
- J. Equipment: Equip each metal locker with identification plate and the following, unless otherwise indicated:
 - 1. Three-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.
- K. Accessories:
 - 1. Continuous Base: Fabricated from 0.0677-inch-thick, cold-rolled steel sheet.
 - 2. Continuous Sloping Tops: Fabricated from minimum 0.0428-inch-thick, cold-rolled steel sheet; approximately 20-degree pitch. Provide where shown on drawings.
 - 3. Recess Trim: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
 - 4. Filler Panels: Fabricated from 0.0428-inch-thick, cold-rolled steel sheet.
- L. Finish: Baked enamel, color as selected by Architect from manufacturer's full range.

2.2 STUDENT LOCKERS

- A. General: Three-tier, heavy-duty corridor lockers, designed for quiet operation.
- B. Basis of Design: Republic Storage Systems, *Quiet Lockers*, or approved equal furnished complete with all required closures, fillers, and trim.
- C. Types:
 - 1. Metal Three-tier: 18 inches wide, 15 inches deep, and 72 inches high.
- D. Accessories: For each student locker provide the following:
 - 1. Recessed stainless steel handle with embossed door pull and integral combination locks.
 - 2. Spring latch with automatic engagement.
 - 3. Number plate.
 - 4. Bookshelf.
 - 5. Two single-prong coat hooks on side walls of locker.

2.3 LOCKER BENCHES

- A. General: Provide locker benches fabricated by same manufacturer as metal lockers.
- B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:
 - 1. Laminated maple with one coat of clear sealer on all surfaces, and one coat of clear lacquer on top and sides.
- C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors.

2.4 FABRICATION

- A. General: Fabricate metal lockers square, rigid, and without warp; with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch.
 - 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet, unless otherwise indicated.
 - 2. Provide fasteners, filler plates, supports, clips, and closures as required for a complete installation.
- B. Unit Principle: Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
- C. All-Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections, with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds flush.
- D. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.
- E. Coat Rods: Fabricated from steel; nickel plated.
- F. Identification Plates: Manufacturer's standard etched, embossed, or stamped aluminum plates; with numbers and letters at least 3/8 inch (9 mm) high.

- G. Legs: Formed by extending vertical frame members or by attaching gusset-type legs to locker body; with provision for fastening to floor; finished to match lockers.
 - 1. Closed Bases: Fabricate bases without overlap or exposed fasteners; finished to match lockers.
- H. Continuous Base: Formed into channel or Z profile for stiffness, and fabricated in lengths as long as practicable to enclose base and base ends of metal lockers; finished to match lockers.
- I. Continuous Sloping Tops: Fabricated in lengths as long as practicable, without visible fasteners at splice locations; finished to match lockers.
 - 1. Sloped top corner fillers, mitered.
- J. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.
- K. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practicable; finished to match lockers.
- L. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip joint filler angle formed to receive filler panel.
- M. Boxed End Panels: Fabricated with 1-inch- (25-mm-) wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- N. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
 - 1. Provide one-piece panels for double-row (back-to-back) locker ends.
- O. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.
- C. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.
- D. Powder-Coat Finish: 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

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion, using concealed fasteners.
 - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
 - 3. Anchor back-to-back metal lockers to floor.
- B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.
- C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
- D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 111300

LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Dock bumpers.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work for recessed loading dock equipment.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, rated capacities, operating characteristics, furnished specialties, accessories, dimensions of individual components and profiles, and finishes.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show fabrication and installation details. 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.
- D. Qualification Data: For Installer

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each type of loading dock equipment through one source from a single manufacturer.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle dock equipment in a manner to avoid significant or permanent damage to fabric or frame.
 - 1. Comply with manufacturer's written instructions for minimum and maximum temperature requirements for storage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish heights of loading docks and proceed with fabricating loading dock equipment without field measurements. Coordinate loading dock construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate installation of anchorages for loading dock equipment. 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold formed.
- C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- D. Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.
- E. Pressure-Treated Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried, and pressure treated with waterborne preservatives to comply with AWPA C2.

2.2 DOCK BUMPERS

- A. Manufacturers:

1. American Floor Products (AFCO).
2. Chalfant Dock Equipment.
3. Durable Corporation.
4. 4Front Engineered Solutions.

- B. Laminated-Tread Bumpers: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch-diameter, steel supporting rods that are welded at one end to 1/4-inch-thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch of tread plies extending beyond the face of closure angles.
- C. Anchorage Devices: Hot-dip galvanized steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated.

2.3 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish loading dock equipment after assembly and testing.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M for iron and steel loading dock equipment.
 2. ASTM A 153/A 153M for iron and steel hardware for loading dock equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of loading dock equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordinate size and location of loading dock equipment indicated to be attached to or recessed into concrete or masonry, and furnish anchoring devices with templates, diagrams, and instructions for their installation.

3.3 INSTALLATION

- A. General: Install loading dock equipment, including accessories as required for a complete installation.
- B. Dock Bumpers: Attach dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.4 ADJUSTING AND CLEANING

- A. Adjust loading dock equipment for proper, safe, efficient operation.
- B. Restore marred, abraded surfaces to their original condition.

END OF SECTION

SECTION 113100

APPLIANCES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

- 1. Appliances.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

- 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

- 1. Division 22 - PLUMBING for water distribution piping connections, drainage and vent piping connections, sinks, and waste disposers.

- 2. Division 26 - ELECTRICAL for services and connections to appliances.

1.3 SUBMITTALS

- A. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.

- B. Product Data: For each type of product indicated. Include operating characteristics, dimensions of individual appliances, and finishes for each appliance.

- C. Appliance Schedule: For appliances; use same designations indicated on Drawings.

- D. Maintenance Data: For each product to include in maintenance manuals.

- E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.

- B. Source Limitations: Provide products from same manufacturer for each type of appliance required.
 - C. Regulatory Requirements: Comply with provisions of the following product certifications:
 - 1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
 - 3. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.
 - D. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with Massachusetts Architectural Access Board requirements and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
 - E. Energy Ratings: Provide residential appliances that carry labels indicating energy-cost analysis (estimated annual operating costs) and efficiency information as required by the FTC Appliance Labeling Rule.
 - 1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.
 - F. Switches: Provide mercury-free switches in appliances.
 - G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.5 WARRANTY
- A. Special Warranties: Manufacturer's standard form in which manufacturer of each appliance specified agrees to repair or replace residential appliances or components that fail in materials or workmanship within manufacturer's standard warranty period.

PART 2 - PRODUCTS

2.1 APPLIANCES

- A. Appliance Schedule: ((insert model numbers))
 - 1. Cooking equipment including:
 - a. Electric cooktops.
 - b. Gas cooktops.
 - c. Electric ranges.
 - d. Gas ranges.
 - e. Electric wall ovens.
 - f. Gas wall ovens.
 - 2. Ventilation range hoods.
 - 3. Refrigerator/freezers.
 - 4. Freezers.
 - 5. Icemakers.
 - 6. Cleaning appliances:

- a. Dishwashers.
- b. Clothes washers.
- c. Clothes dryers.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
- C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
- D. Utilities: Refer to Division 22 - PLUMBING for plumbing requirements and Division 26 - ELECTRICAL for electrical requirements.

3.3 CLEANING AND PROTECTION

- A. Test each item to verify proper operation. Make necessary adjustments.
- B. Verify that accessories required have been furnished and installed.
- C. Remove packing material from appliances and leave units in clean condition, ready for operation.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain appliances.

END OF SECTION

SECTION 115210

PROJECTION SCREENS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Manually-operated projection screens.
 - 2. Electrically-operated projection screens.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 095100 - ACOUSTICAL CEILINGS for coordination with ceiling-recessed units.
 - 2. Division 26 - ELECTRICAL for electrical service and connections including metal device boxes for switches and conduit, where required, for low-voltage control wiring.

1.3 SUBMITTALS

- A. Product Data: For each type of screen indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show layouts and types of projection screens. Include the following:
 - 1. Location of screen centerline relative to ends of screen case.
 - 2. Location of wiring connections.
 - 3. Location of seams in viewing surfaces.
 - 4. Drop length.
 - 5. Connections to supporting structure for pendant- and recess-mounted screens.
 - 6. Anchorage details.
 - 7. Details of juncture of exposed surfaces with adjacent finishes.
 - 8. Frame details.
 - 9. Accessories.
 - 10. Wiring Diagrams: For electrically operated units.

- D. Maintenance Data: For projection screens to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver projection screens until building is enclosed and other construction within spaces where screens will be installed is substantially complete and ready for screen installation.
- B. Store rear-projection screens in manufacturer's protective packaging and according to manufacturer's written instructions.

1.6 COORDINATION

- A. Coordinate layout and installation of projection screens with adjacent construction, including ceiling framing, light fixtures, HVAC equipment, and partitions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Bretford Manufacturing, Inc.
 2. Da-Lite Screen Co., Inc
 3. Draper Inc.
 4. Stewart Filmscreen.

2.2 FRONT-PROJECTION SCREENS

- A. Manually Operated Screens: Manufacturer's standard spring-roller-operated units, consisting of case, screen, mounting accessories, and other components necessary for a complete installation.
 1. Screen Mounting: Top edge securely anchored to a 3-inch-diameter, rigid steel roller; bottom edge formed into a pocket holding a tubular metal slat, with ends of slat protected by plastic caps, and with a saddle and pull attached to slat by screws.
- B. Electrically Operated Screens: Manufacturer's standard units consisting of case, screen, motor, controls, mounting accessories, and other components necessary for a complete installation. Provide units that are listed and labeled as an assembly by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 1. Line Voltage Control: Remote, 3-position control switch installed in recessed metal device box with flush cover plate matching other electrical device cover plates in room where switch is installed.
 2. Motor in Roller: Instant-reversing motor of size and capacity recommended by screen manufacturer; with permanently lubricated ball bearings, automatic thermal-overload

protection, preset limit switches to automatically stop screen in up and down positions, and positive-stop action to prevent coasting. Mount motor inside roller with vibration isolators to reduce noise transmission.

3. Screen Mounting: Top edge securely anchored to rigid metal roller and bottom edge formed into a pocket holding a 3/8-inch- diameter metal rod with ends of rod protected by plastic caps.
 - a. Roller for end-mounted motor supported by self-aligning bearings in brackets.
 - b. Roller for motor in roller supported by vibration- and noise-absorbing supports.
- C. Recessed, Electrically Operated Screens with Automatic Ceiling Closure: Motor in roller units designed and fabricated for recessed installation in ceiling; with bottom of case composed of two panels fully enclosing screen, motor, and wiring, one panel hinged and designed to open and close automatically when screen is lowered and fully raised, the other removable or openable for access to interior of case.
 1. Provide screen case constructed to be installed with underside flush with ceiling.
 2. Prime paint surfaces of screen case that will be exposed to view in the finished work.
- D. Screen Material and Viewing Surface:
 1. Matte-White Viewing Surface: Peak gain of 0.9 to 1.0, and gain of not less than 0.8 at an angle of 50 degrees from the axis of the screen surface.
 2. Mildew Resistance: Rating of 0 or 1 when tested according to ASTM G 21.
 3. Flame Resistance: Passes NFPA 701.
 4. Seamless Construction: Provide screens, in sizes indicated, without seams.
 5. Edge Treatment: Black masking borders.
 6. Provide extra drop length of dimension indicated to comply with the following requirements for fabric color and location of drop length:
 7. Size of Viewing Surface: [As indicated on the Drawings.](#)

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.
- B. Install front-projection screens with screen cases in position and in relation to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
 1. Install low-voltage controls according to NFPA 70 and manufacturer's written instructions.
 - a. Wiring Method: Install wiring in raceway except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and cables except in unfinished spaces.
 2. Test electrically operated units to verify that screen controls, limit switches, closure, and other operating components are in optimum functioning condition.

3. Test manually operated units to verify that screen operating components are in optimum functioning condition.

3.2 PROTECTING AND CLEANING

- A. After installation, protect projection screens from damage during construction. If damage occurs despite such protection, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION

SECTION 115313

LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:

1. High performance bench top laboratory fume hood.
2. High performance floor-mounted laboratory fume hood.
3. Laboratory gas and electrical service fittings in fume hoods.
4. Piping and wiring within fume hoods for service fittings, light fixtures, fan switches, and other electrical devices included with fume hoods.
5. Install existing fume hood, relocated from existing school.

- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.

1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:

1. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring fume hoods.
2. Division 23 Sections for fume hood duct connections, including ducts and exhaust fans and air flow indicators and alarms.
3. Division 23 and 26 Sections for connecting service utilities at top of fume hoods. Piping and wiring within fume hoods are specified in this Section.
4. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for field quality-control testing of fume hoods.

1.3 PERFORMANCE REQUIREMENTS

- A. Static-Pressure Loss: Not more than 3/8-inch wg at 100-fpm face velocity when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

- B. Structural Performance: Provide fume hood components capable of withstanding the following loads without permanent deformation, excessive deflection, or binding of cabinet drawers and doors:

1. Fume Hood Base Stands: 50-lb/ft. work top, 75 lb/ft. on work top, plus weight of hood.

- C. Delegated Design: Design fume hoods, including comprehensive engineering analysis by a qualified professional engineer, using seismic performance requirements and design criteria indicated.
 - 1. Hood design shall comply with ASHRAE 110 "As Manufactured" test.
- D. Seismic Performance: Fume hoods shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. Design earthquake spectral response acceleration, short period (Sds) for Project is 0.17g.
 - 2. Component Importance Factor is 1.5.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For laboratory fume hoods. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Indicate details for anchoring fume hoods to permanent building construction including locations of blocking and other supports. Include calculations demonstrating that anchorages comply with seismic performance requirements.
 - 2. Indicate locations and types of service fittings together with associated service supply connection required.
 - 3. Indicate duct connections, electrical connections, and locations of access panels.
 - 4. Include roughing-in information for mechanical, plumbing, and electrical connections.
 - 5. Show adjacent walls, doors, windows, other building components, laboratory casework, and other laboratory equipment. Indicate clearances from above items.
 - 6. Include layout of fume hoods in relation to lighting fixtures and air-conditioning registers and grilles.
 - 7. Include coordinated dimensions for laboratory equipment specified in other Sections.
- D. Samples for Verification: For fume hood exterior finishes, interior lining, and work top material, in manufacturer's standard sizes.
- E. Delegated-Design Submittal: For fume hoods indicated to comply with seismic performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Product Test Reports: Showing compliance with specified performance requirements for as-manufactured containment and static pressure loss based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency.
- G. Source quality-control reports.
- H. Field quality-control reports for containment only. Refer to Division 23 for Testing and Balancing of laboratories.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Laboratory Fume Hoods: Obtain fume hoods from single manufacturer.

1. Obtain from same source as laboratory casework specified in Division 12 Section "Laboratory Casework."
 - B. Product Designations: Drawings indicate nominal sizes, types, and configurations of fume hoods and are not meant to be proprietary. Specified manufacturers' "standard" hoods of similar sizes, types, and configurations, and complying with the Specifications, will be considered. See Division 01 Section "Product Requirements."
 - C. Product Standards: Comply with SEFA 1, "Laboratory Fume Hoods - Recommended Practices." Provide fume hoods UL listed and labeled for compliance with UL 1805.
 - D. Safety Glass: Products complying with testing requirements in 16 CFR 1201 for Category II materials.
 1. Permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
 - E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install fume hoods until building is enclosed, wet work and utility roughing-in are complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- 1.8 COORDINATION
- A. Coordinate layout and installation of framing and reinforcements for lateral support of fume hoods.
 - B. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.
- 1.9 EXTRA MATERIALS
- A. Furnish complete touchup kit for each type and color of fume hood finish provided. Include fillers, primers, paints, and other materials necessary to perform permanent repairs to damaged fume hood finish.
- 1.10 WARRANTY
- A. Provide extended 10-year warranty for defects including but not limited to: rusting, peeling, blistering, fading of fume hood "painted" and stainless steel finishes, failure of cable/counterweight system, damper, sash guides.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. No Substitutions.:
 - 1. Concept by Fisher Hamilton, LLC.
 - 2. Mott Manufacturing, Ltd.
 - 3. Lab Crafters Inc., Ronkonkoma, NY.
- B. Bench Top Hoods Basis-of-Design: Air Sentinel by Lab Crafters.
- C. Floor-Mounted Hoods Basis-of-Design: Air Sentry by Lab Crafters.

2.2 MATERIALS

- A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A 1008/A 1008M; matte finish; suitable for exposed applications.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type **316**, stretcher-leveled standard of flatness.
- C. Glass-Fiber-Reinforced Polyester: Polyester laminate with a chemical-resistant gel coat on the exposed face, and having a flame-spread index of 25 or less per ASTM E 84.
- D. Epoxy: Factory molded, modified epoxy-resin formulation with smooth, nonspecular finish.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Durcon Company (The).
 - b. Epoxyn Products.
 - c. Laboratory Tops, Inc.
 - d. Prime industries, inc.
 - 2. Physical Properties:
 - a. Flexural Strength: Not less than 10,000 psi.
 - b. Modulus of Elasticity: Not less than 2,000,000 psi.
 - c. Hardness (Rockwell M): Not less than 100.
 - d. Water Absorption (24 Hours): Not more than 0.01 percent.
 - e. Heat Distortion Point: Not less than 380 deg F.
 - f. Flame-Spread Index: 25 or less per ASTM E 84.
 - 3. Chemical Resistance: Epoxy-resin material has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.4.5:
 - a. No Effect: Acetic acid (98 percent), acetone, ammonium hydroxide (28 percent), benzene, carbon tetrachloride, dimethyl formamide, ethyl acetate, ethyl alcohol, ethyl ether, methyl alcohol, nitric acid (70 percent), phenol, sulfuric acid (60 percent), and toluene.
 - b. Slight Effect: Chromic acid (60 percent) and sodium hydroxide (50 percent).
 - 4. Color: As selected by the Architect.

- E. Glass-Fiber Cement Board: ASTM C 1186.
- F. Glass: Clear, laminated tempered glass complying with ASTM C 1172, Kind LT, Condition A, Type I, Class I, Quality-Q3; with two lites not less than 3.0 mm thick and with clear, polyvinyl butyral interlayer.
- G. Polycarbonate Glazing: Clear, uncoated polycarbonate sheet manufactured by extrusion process and complying with the following requirements:
 - 1. Impact Resistance: 12 to 16 ft-lbf/in. per ASTM D 256, Method A.
 - 2. Elongation and Modulus of Elasticity: 110 percent maximum and 340,000 psi, respectively, per ASTM D 638.
 - 3. Heat Deflection: 270 deg F at 264 psi per ASTM D 638.
 - 4. Flame-Spread Index: 25 or less per ASTM E 84.
- H. Fasteners: Provide stainless-steel fasteners where exposed to fumes.

2.3 BENCH TOP LABORATORY FUME HOOD

A. Design Requirements:

- 1. Fume hoods shall function as ventilated, enclosed workspaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
- 2. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section.
- 3. Average illumination of work area at the work surface: Minimum 90 foot-candles (970 lx). Work area shall be defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to the bottom of the sash handle at its full open vertical position (a height of 24 inches [610 mm]).
- 4. Fume Hoods are designed to operate with an average face velocity between 60 FPM (0.30 m/s) and 100 FPM (0.51 m/s) through the operating sash opening.
- 5. Fume hood shall be designed to minimize static pressure loss with adequate slot area and exhaust collar configuration. Average static pressure loss readings taken 3 diameters above the hood outlet from 4 points, 90 degrees apart, shall not exceed 0.40" with a face velocity of 100 FPM.

B. Construction Features:

- 1. Superstructure:
 - a. Wall: Rigid, self-supporting assembly of double wall construction, 4.5" thick. Double wall shall consist of an 18-gauge (1.2 mm) sheet steel outer shell and inner wall. Wall shall be finished with a white chemical resistant powder-coat. Hoods shall be completely factory assembled to form a rigid, self-supporting structure.
 - b. Front Panel Bypass Grille: Front panel to have low resistance type, open slots for air bypass. Front panel to be powder-coat or polyurethane wet-spray finish, color selected by Owner or Architect from manufacturer's standard color offering.
 - c. Ceiling Closure Panel: Minimum 20-gauge steel, finish to match hood color selection.
- 2. Fastenings:
 - a. Exterior structural members attachments: Sheet metal screws, zinc plated.
 - b. Interior fastening devices concealed. Exposed screws not acceptable.

- c. Exterior panel member fastening devices concealed. Exposed screws not acceptable.
3. Face Opening:
 - a. Posts: Streamlined shape with all edges and corners exposed to the sash opening radiused.
 - b. Air Foil: Bottom horizontal foil shall provide nominal 1-inch (24 mm) bypass when sash is in the closed position. Bottom foil to be constructed of steel with a chemical resistant powder-coat finish
4. Bypass: Bypass shall have a mechanically actuated plate that closes bypass when the vertical sash is raised, creating a turning vane for proper airflow dynamics in the upper chamber of the fume hood. When vertical sash is closed, bypass plate shall pivot to allow bypass air to enter the fume hood through the front panel bypass slots.
5. Sash:
 - a. Full view type with clear, unobstructed, side to side view of fume hood interior and service fixture connections.
 - b. Sash to be Combination style sash with both vertical and horizontal moving glass panels. Horizontal sliding sashes are on two tracks. Each panel must ride on top hung rollers supported from top rail only.
 - c. Sash handle: Aerodynamic contoured design with a chemical resistant finish.
 - d. Counter balance system: Single weight, pulley, cable, counter balance system shall prevent sash tilting and permit one finger operation at any point along full width pull. Design system to hold sash at any position without creep and prevent sash drop in the event of cable failure. Open and close sash against rubber bumper stops. Sash cables shall be Stainless steel, 1/8-inch (3 mm) diameter, 7x19 strand. Pulley assembly for sash cable: 2-inch (48 mm) diameter, nylon construction, ball bearing type, with cable retaining device.
 - e. Sash glass: 1/4-inch thick laminated safety glass.
 - f. Sash guides: Corrosion resistant plastic.
6. Baffles:
 - a. Provide baffles to control air vectors into and through the fume hood. Fabricate of steel with a white chemical resistant powder-coat.
 - b. Baffle slots are fixed in optimum position and cannot be maladjusted by user.
 - c. Baffle design which permits close off of all slots are not acceptable.
7. Work Surfaces:
 - a. Epoxy resin, 1 in. thick. Color: Black
 - b. 1/4 in. Raised edge on the entire perimeter of the countertop creating a dished work area
8. Lighting:
 - a. Fixture: 2 lamp, rapid start, UL listed fluorescent light fixture with sound rated ballast installed on exterior of fume hood roof. Provide safety glass panel sealed to the hood roof.
 - b. Interior of fixture: White, high reflecting plastic enamel.
 - c. Size: Largest possible up to 48 inches (1.2 m) for hoods with superstructures up to 6 feet (1.8 m). Provide two (2) 36-inch (0.9 m) fixtures for hoods with 8 foot (2.4 m) superstructures.
 - d. Lamps: T8 lamps.
 - e. Illumination: An average of 90 foot-candle (970 lx) minimum.
9. Electrical Power:
 - a. Three wire grounding type receptacles, rated at 120 VAC at 20 amperes.
 - b. Factory install receptacles, lighting, electrical fittings and wiring.
 - c. Pre-wire all electrical services to a junction box located on hood roof for single point power connection.
10. Service Fittings and Piping: Hoods shall be factory pre-piped to a point of connection 2 inches (48 mm) above the hood roof. Pressure test all pre-piped lines in the factory.

11. Exhaust Outlet: Exhaust collar sized per fume hood model number.

- C. Airflow Alarm: Provide a face velocity monitor mounted on the post of the fume hood, which alerts the user when the average face velocity falls below Owner set point. Monitor must provide LED's indicating normal and alarm conditions and an audible horn when in alarm mode. Monitor must provide a digital readout of the velocity or an alpha text message of the hood condition, LED's indicating normal and alarm conditions and an audible horn when in alarm mode. The controller/monitor must have the ability to digitally communicate with a building automation system.

2.4 FLOOR MOUNTED LABORATORY FUME HOODS

A. Design Requirements:

1. Fume hoods shall function as ventilated, enclosed work spaces, designed to capture, confine and exhaust fumes, vapors and particulate matter produced or generated within the enclosure.
2. Fume hood shall operate safely with an average face velocity between 60 FPM and 75 FPM through the fully opened top or bottom vertical sash and the hood shall operate safely with a face velocity of 60 FPM through the maximum horizontal sash opening.
3. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section.
4. Average illumination of work area: Work area shall be defined as the area inside the superstructure from side to side and from face of baffle to the inside face of the sash, and from the working surface to a height of 28 inches (710 mm).
5. Fume hood shall be designed to minimize static pressure loss with adequate slot area and bell shaped exhaust collar configuration.
6. At Floor Mounted Hoods FH-125415 and FH-125416 provide XP dP sensor.

B. Construction Features:

1. Superstructure:
 - a. Wall: For safety related to physical structural support superstructures shall be double wall type with outer wall of polyurethane-coated steel and the inner galvanized wall, covered with 1/4" thick chemically resistant white fiberglass reinforced polyester. The exterior shall be constructed of 18 gauge C.R.S. finished in reagent resistant catalytically activated polyurethane, color selected from manufacture's standard color chart by architect/lab planner. The interior wall shall be securely held in place with concealed fastenings with corrosion protection. Hoods shall be completely factory assembled to form a rigid, self-supporting structure. Frame construction in lieu of full steel wall construction is unacceptable.
 - b. Dimensions: Interior dimensions front and back and vortex chamber to be mathematically sized to support a Bi-Stable vortex.
 - c. Bypass: By pass air is introduced below the sash through multi-channel slots in airfoil, when the sash is closed. Above sash bypass grilles are not acceptable due to their adverse effect upon the maintenance of the vortex roll. All air shall enter the hood through the sash opening and through multi-vector slots below the sash.
 - d. Ceiling closure panel: Minimum 20 gage thick, finish to match hood.
2. Face Opening:
 - a. The following requirements are to prevent reverse eddy airflow. Area surrounding sash opening to be rounded to create an aerodynamic configuration with side posts maximum 4.5" in width. Side posts to incorporate an airfoil design.
 - b. Removable Front: Hood front section shall be removable to facilitate the hood's access to its final location. Fume Hood front to include posts, tracks, sash with weight, pulleys, cable, foil, plumbing fixtures and pre-wired electrical fixtures. Fume

hood front with sash and pre-wired electrical components, including the light box, are to be removable from hood body as a complete assembled one piece unit (only using quick disconnects for the cable components or electrical components).

3. Sash:
 - a. Full view type with clear, unobstructed, side to side view of fume hood interior and service fixture connections.
 - b. Sash handle shall be aerodynamically designed construction with chemically resistant coating.
 - c. Double vertical sash: Hood shall have two vertical sashes on two tracks.
 - d. Combination Sash: Where indicated on the drawings, combination sashes shall be provided. Combination style with both vertical and horizontal moving glass panels shall have the Horizontal sliding sashes are on two tracks. Each panel must ride on top hung rollers supported from top rail only.
 - e. Counter balance system: Single weight, pulley, cable, counter balance system shall prevent sash tilting and permit one finger operation at any point along full width pull. Design system to hold sash at any position without creep and prevent sash drop in the event of cable failure. Sash and counterbalance mechanism to be life cycle tested to withstand a minimum of 100,000 cycles without signs of fatigue. Open and close sash against rubber bumper stops. Sash cables shall be Stainless steel, 1/8 inch (3 mm) diameter, 7x19 strand. Pulley assembly for sash cable: 2 inch (48 mm) diameter, nylon construction, ball bearing type, with cable retaining device.
 - f. Sash glass: 1/4 inch thick laminated safety glass.
4. Liners: Fiberglass reinforced polyester, 1/4 inch thick. Color: white. These panels to have at least a "Laboratory Grade finish" when tested per the chemical spot test in the Scientific Equipment and Furniture Association (SEFA) SEFA 8-1999 Standard. Chemical resistance test data to be supplied to the Owner for his evaluation for intended use, upon Owner request.
5. Baffles:
 - a. Upper Baffle: Chemically resistant powder coated aluminum, automatically adjusting baffle with slots at top, center and bottom to include automated baffle controls unless otherwise indicated. Baffle control to maintain vortex and containment with sash movement, cross drafts and other factors. See "Baffle Controls/Alarm Systems" section for more information on baffle actuator. Chemical resistance test data on baffle coating to be supplied to the Owner for his evaluation for intended use, upon Owner request. Baffles that do not adjust automatically are unacceptable.
 - b. Lower Baffle: Chemically resistant powder coated aluminum, fixed baffle with slots at sides, center and bottom. Baffle shall create a separate rear plenum that is exhausted through a separate dedicated exhaust collar on the fume hood roof.
6. Lighting:
 - a. Fixture: 2 lamp, rapid start, UL listed fluorescent light fixture with sound rated ballast installed on exterior of fume hood roof. Provide safety glass panel sealed to the hood roof.
 - b. Interior of fixture: White, high reflecting plastic enamel.
 - c. Size: Largest possible up to 48 inches (1.2 m) for hoods with superstructures up to 6 feet (1.8 m). Provide two (2) 36 inch (0.9 m) fixtures for hoods with 8 foot (2.4 m) superstructures.
 - d. Lamps: T8 lamps.
 - e. Illumination: Minimum 80 footcandle (860 lx) at benchtop height
7. Electrical Power:
 - a. Three wire grounding type receptacles rated at 120 VAC at 20 amperes.
 - b. Factory install receptacles, lighting, electrical fittings and wiring.
 - c. Pre-wire to a junction box located on hood roof for single point power connection.
 - d. Interior Receptacles (optional): Factory install GFCI receptacles on the interior fume hood wall. Receptacles must have a self closing cover plate. Receptacle

must have a power kill switch mounted on the fume hood post and clearly labeled as such. This system must be included in the manufacturer's UL 1805 file and approved by UL.

8. Service Fittings and Piping:
 - a. Provide services as shown on hood schedule and/or drawings.
 - b. Hoods shall be factory pre-piped to a point of connection 2 inches (48 mm) above the hood roof. Pressure test all pre-piped lines in the factory. Provide documentation of pressure test results for all fume hood plumbing services.
 - c. Valves: Needlepoint type with self centering cone tip and seat of hardened stainless steel. Tip and seat shall be removable and replaceable. Valve shall be actuated by a remote control rod with handle at the fume hood post.
 - d. Piping: Copper for water, air and vacuum and black iron for gas services.
 - e. Outlets exposed to hood interior: Brass with chemically resistant color coded powder coating.
 - f. Acceptable manufacturer: WaterSaver, ColorTech line of products or Owner/Architect approved equal.
9. Exhaust Outlet:
 - a. Upper exhaust: Bell mouth exhaust collar sized per fume hood model number.
 - b. Lower Exhaust: rectangular exhaust collar sized per fume hood model number.
10. Instruction Plate: Provide instructions on fume hood exterior with condensed information covering recommended locations for apparatus and accessories, use of sash, and recommended safe operating procedures.
11. UL Label: Clearly visible label affixed to hood front identifying fume hood as UL Classified. List the UL file number for verification of UL Classification.

C. Baffle Control and Airflow Monitor:

1. The Vortex Control System is a control system integral to the fume hood superstructure which includes baffle/slot control, to enhance containment based upon maintenance of the vortex roll with-in the hood reacting to variables which could affect containment including sash movement, hood loading, cross-drafts, personnel movement and other variables potentially affecting containment. Hood baffle shall incorporate three slots associated with an automated baffle positioning control to optimize slot velocity openings for maximum containment in response to variables potentially affecting containment. Containment as specified herein must be maintained. Baffle control system includes roof mounted baffle Actuator, Controller/Low Flow Alarm, and Sensor. Fume hood manufacturer shall provide and factory install the baffle control components for each fume hood indicated on the drawings. In addition to maintaining the vortex airflow pattern, the hood airflow monitor alerts the user when the average face velocity falls below Owner set point. Monitor must provide a digital readout of the velocity or an alpha text message of the hood condition, LED's indicating normal and alarm conditions and an audible horn when in alarm mode. The controller/monitor must have the ability to digitally communicate with a building automation system.

2.5 FABRICATION

- A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations. Fume hoods shall be capable of being partly disassembled as necessary to permit movement through a 47-by-79-inch door opening.
- B. Steel Exterior: Fabricate from steel sheet, not less than 0.050 inch thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil and to allow access to plumbing lines and service fittings. Apply chemical-resistant finish to interior and exterior surfaces of component parts before assembly.

- C. Ends: Fabricate with double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even airflow. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.
- D. Splay top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.
- E. Interior Lining: Provide the following unless otherwise indicated:
 - 1. Glass-fiber-reinforced polyester, not less than 1/4 inch thick.
- F. Lining Assembly: Unless otherwise indicated, assemble with stainless-steel fasteners or epoxy adhesive, concealed where possible. Seal joints by filling with chemical-resistant sealant during assembly.
 - 1. Fasten lining components to a rigid frame assembly fabricated from stainless steel and to which exterior panels are attached.
 - 2. Punch fume hood lining side panels to receive service fittings and remote controls. Provide removable plug buttons for holes not used for indicated fittings.
- G. Rear Baffle: Unless otherwise indicated, provide baffle, of same material as fume hood lining, at rear of hood with openings at top and bottom for airflow through hood. Secure baffle to cleats at rear of hood with stainless-steel screws. Fabricate baffle for easy removal for cleaning behind baffle.
 - 1. Provide preset baffles.
 - 2. Provide epoxy-coated, stainless-steel screen at bottom baffle opening to prevent paper from being drawn into the exhaust plenum behind baffles.
- H. Exhaust Plenum: Full width of fume hood and with adequate volume to provide uniform airflow from hood, of same material as hood lining, and with duct stub for exhaust connection.
 - 1. Duct-Stub Material: stainless steel.
- I. Bypass Grilles: Provide grilles at bypass openings of bypass and restricted bypass fume hoods.
- J. Sashes: Provide operable sashes of type indicated.
 - 1. Fabricate from 0.050-inch- nominal thickness stainless steel. Form into four-sided frame with bottom corners welded and finished smooth. Make top member removable for glazing replacement. Set glazing in chemical-resistant, U-shaped gaskets.
 - 2. Glaze with laminated safety glass.
 - 3. Glaze with 0.236-inch- thick polycarbonate glazing where indicated.
 - 4. Counterbalance vertical-sliding sash with sash weight and stainless-steel chain and sprocket system to hold sash in place regardless of position. Provide ball-bearing sheaves, plastic glides in stainless-steel guides, and stainless-steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.
- K. Airfoil: Unless otherwise indicated, provide airfoil at bottom of fume hood face opening with 1-inch space between airfoil and work top. Sash closes on top of airfoil, leaving 1-inch opening for air intake. Airfoil directs airflow across work top to remove heavier-than-air gases and to prevent reverse airflow.

1. Fabricate airfoil from Type 316 stainless steel.
- L. Light Fixtures: Provide vapor proof, two-tube, rapid-start, fluorescent light fixtures, of longest practicable length; complete with tubes at each fume hood. Shield tubes from hood interior with 1/4-inch- thick laminated glass or 3-mm-thick tempered glass, sealed into hood with chemical-resistant rubber gaskets. Provide units with fluorescent tubes easily replaceable from outside of fume hood.
1. Provide fluorescent tubes with color temperature of 3500 K and minimum color-rendering index of 82.
- M. Base Cabinets: Comply with Division 12 Section "Laboratory Casework." Provide metal base cabinets in finish matching fume hood exterior finish and in sizes as indicated.
1. Provide Corrosive-Resistant Storage Cabinets where indicated.
 - a. Lining: 1/4-inch- thick, polyethylene or polypropylene.
 - b. Provide manufacturer's standard polyethylene or polypropylene vent kit.
 - c. Provide one adjustable polyethylene or polypropylene half depth shelf with spill retention tray.
 - d. Provide removable back panel.
 - e. Provide 1" spill lip at bottom of cabinet.
 2. Provide Flammable Storage Cabinets where indicated. Flammable storage cabinets shall be Factory Mutual Approved and UL listed and in full compliance with NFPA standards and OSHA regulations.
 - a. Provide two, 2" pipe threaded vent outlets with flame arrestors on back of cabinet.
 - b. Provide type 304 stainless steel vent kit where indicated. Coordinate connection of stainless steel vent kit with Division 23.
 - c. Provide grounding screw, field ground cabinet grounding screw to building electrical ground.
 - d. Provide signage: "Caution Flammable – Keep Fire Away".
 - e. Provide capacity signage for each size cabinet.
- N. Fume Hood Base Stands: Fabricated from not less than 2-inch- square, electrically welded steel tubing. Provide leg stretchers where necessary to comply with structural performance requirements. Weld leg stretchers, cross stretchers, and work top support rails to legs, and finish entire assembly with chemical-resistant finish. Provide leveling device at each corner of base stand at floor.
1. Provide clear floor space not less than 30 inches wide by 25 inches deep by 27 inches high within fume hood base stands unless otherwise indicated.
- O. Work Top and Sinks:
1. Work Tops, General: Provide units with smooth surfaces free of defects. Make exposed edges and corners straight and uniformly beveled. Where acid storage cabinets are indicated beneath fume hoods, Do Not provide holes in work tops to accommodate cabinet vents, install vent kits in service hole cutout contained within jamb of fume hood shell as indicated.
 2. Resin Work Tops: Provide front overhang of 1-inch, with continuous drip groove on underside 1/2 inch from edge.
 - a. Work Top Material: Solid epoxy composition.

- b. Work Top Configuration: Raised (marine) edge, 1-1/4 inches thick at raised edge, with beveled edge and corners.
 - P. Work Surface of Floor-Mounted Fume Hoods: Epoxy flooring extended into hood area.
 - Q. Filler Strips: Provide as needed to close spaces between fume hoods or fume hood base cabinets and adjacent building construction. Fabricate from same material and with same finish as fume hoods or fume hood base cabinets, as applicable.
 - a. Provide sight proof vents at base cabinet filler strips.
 - R. Ceiling Extensions: Provide filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods and extending from tops of fume hoods to 1-inches minimum below ceiling.
 - S. Finished Back Panels: Where side surfaces of fume hoods are exposed to view, provide finished side panels matching rest of fume hood enclosure.
 - T. Comply with requirements in Divisions 23 and 26 Sections for installing water and laboratory gas service fittings, piping, electrical devices, and wiring. Install according to Shop Drawings. Securely anchor fittings, piping, and conduit to fume hoods unless otherwise indicated.
- 2.6 CHEMICAL-RESISTANT FINISH
- A. General: Prepare, treat, and finish welded assemblies after welding. Prepare, treat, and finish components that are to be assembled with mechanical fasteners before assembling. Prepare, treat, and finish concealed surfaces same as exposed surfaces.
 - B. Preparation: Clean steel surfaces, other than stainless steel, of mill scale, rust, oil, and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
 - C. Chemical-Resistant Finish: Immediately after cleaning and pretreating, apply fume hood manufacturer's standard two-coat, chemical-resistant, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Chemical and Physical Resistance of Finish System: Finish complies with acceptance levels of cabinet surface finish tests in SEFA 8. Acceptance level for chemical spot test shall be no more than four Level 3 conditions.
 - 2. Colors for Fume Hood Finish: Match Architect's samples.
 - a. Three custom colors required.
- 2.7 ACCESSORIES
- A. Service Fittings: Comply with requirements in Division 12 Section "Laboratory Casework."
 - 1. Provide service fittings with exposed surfaces, including fittings, escutcheons, and trim, finished with acid- and solvent-resistant powder coating complying with requirements in SEFA 7 for corrosion-resistant finishes.
 - 2. Provide Service fitting outlets within the exposed surface color coded coordinated with remote valve handle color index identifier.

- B. Airflow Indicator: Comply with requirements of Division 23. Provide cut outs, where indicated, and back boxes to accommodate "Zone Presence Sensors" and air flow indicator/alarm furnished by Division 23. Coordinate with Airflow Monitor specified in article 2.4 C
- C. Airflow Alarm: Comply with requirements of Division 23. Provide cut outs, where indicated, and back boxes to accommodate "Zone Presence Sensors" and air flow indicator/alarm furnished by Division 23.
- D. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 18-inches of sash height. Sash stops can be manually released to open sash fully for cleaning fume hood and for placing large apparatus within fume hood.
- E. Lattice Assembly: Stainless-steel, vertical and horizontal rod lattice assembly with 3/4-inch-diameter rods at approximately 12 inches o.c. with 2 flush socket receptacles for mounting.
 - 1. Size: As Indicated on fume hood drawings.

2.8 SOURCE QUALITY CONTROL

- A. Demonstrate fume hood performance before shipment by testing fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article. Provide testing facility, instruments, equipment, and materials needed for tests.

2.9 FUME HOOD SCHEDULE

Room Name	Fume Hood Size	Gas Requirements	Base Cabinets	Exhaust Volume
FH-125412-RAD ROOM 1501	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125413-FUME HOOD ALCOVE 1506	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125414-MEDIA PREP/BUFFER PREP 1702	4' Floor Mounted Hood	VAC/COMP AIR		540 CFM
FH-125415, FH-125416- HAZARDOUS WASTE/CHEM STOR 2407	(2) 8' Floor Mounted Hoods			840 CFM EA.
FH-125417-MEDIA PREP 2405	4' Fume Hood	VAC	Combo Flamma- ble/Corrosive	340 CFM
FH-125418-MEDIA PREP 2613	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125419-OPEN LAB 2608	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-1254120-PPD BUFFER PREP 2712	4' Fume Hood	VAC	Combo Flamma- ble/Corrosive	340 CFM
FH-125421-FUME HOOD ALCOVE 3502	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125422-FORMULATION 3509	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125423-GMP FUME HOOD ALCOVE 3610	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125424-FUME HOOD ALCOVE 3611	6' Fume Hood	VAC	Flammable/Corrosive	550 CFM
FH-125425-FH-125426- FUME HOOD ALCOVE 3614	(2) 6' Fume Hood	VAC	Flammable/Corrosive	550 CFM EA.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fume hoods according to Shop Drawings and manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels, but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- B. Comply with requirements in Division 12 Section "Laboratory Casework" for installing fume hood base cabinets, work tops, and sinks.

3.3 FIELD QUALITY CONTROL

- A. Field test installed fume hoods according to ASHRAE 110 as modified in "Performance Requirements" Article to verify compliance with performance requirements.
 - 1. Adjust fume hoods, hood exhaust fans, and building's HVAC distribution system, or replace hoods and make other corrections until tested hoods perform as specified.
 - 2. After making corrections, retest fume hoods that failed to perform as specified.

3.4 ADJUSTING AND CLEANING

- A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.
- B. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION

SECTION 116620
ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Attention is directed to the Contract and General conditions and all Sections within Division 1 – GENERAL REQUIREMENTS, which are hereby made a part of this Section of the Specifications.
- B. Examine all other Sections of the Specifications for additional requirements that affect this Section whether or not specifically mentioned in this Section.
- C. Coordinate work with that of all other trades affecting, or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.2 SUMMARY

- A. Furnish and install backboards, cables and other athletic equipment as indicated on Drawings, as specified herein, or both. Include delivery to the building, unpacking, setting in place and attachment, as required for complete installation.
- B. Verify all dimensions relative to equipment to be installed by taking actual field measurements at the job site prior to equipment fabrication.
- C. The Work of this Section includes, but is not limited to, the following:
 - 1. Basketball backstops, including all steel required to support backstops from structure.
 - 2. Wall padding.
 - 3. Volleyball net and standards.
 - 4. Gymnasium divider curtain.
 - 5. Scoreboard and shot clocks.
- D. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
- E. Products furnished, but not installed, under this Section include the following:
 - 1. Volleyball floor inserts, for installation under Section 096460 – ATHLETIC WOOD FLOORING.
 - 2. Wall-mounted controls, installed under Section 260000 – ELECTRICAL.
- F. Related work includes but is not limited to the following work covered in other sections:
 - 1. Wood trim for wall pads: Section 064020 – INTERIOR ARCHITECTURAL WOODWORK.
 - 2. Field painting of factory-primed components of equipment: Section 099000 – PAINTING AND COATING.

3. Power for electric basketball backstop winches, scoreboard and shot clocks, and installation of associated keyswitches and twist-lock receptacles: Section 260000 – Electrical.

1.3 SUBMITTALS

- A. Prepare and submit submittals in accordance with requirements of Section 013300 - Submittals and in the manner described therein.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018113.
 2. Show installed costs for all items listed.
- C. Shop Drawings:
 1. Scale: No less than 1/4" scale and shall show layout of all equipment and all electrical connections required.
 2. 1/2" scale Shop Drawings shall be submitted for all fabricated and shop-made equipment showing details of construction and attachment to work of other trades.
 3. The exact location of all connections shall be dimensioned on Shop Drawings for all equipment and labeled with information necessary for coordination of work with other trades.
 4. Obtain and verify all dimensions, measurements and conditions, and assume responsibility for correctness of same.
- D. Samples:
 1. Gymnasium divider curtain Fabric: Not less than 12 inches (305 mm) square of open mesh, and of opaque fabric.
 2. Wall pad Fabric: Not less than 12 inches (305 mm) square.
- E. Manufacturer's Data: Submit manufacturer's product data with performance, operating and electrical characteristics for all equipment together with catalogue cuts.
- F. No fabrication, shipment, or installation shall take place until Shop Drawings and manufacturer's cuts have been approved.

1.4 OPERATION INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Instruct to the owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and their parts.
- B. Furnish in accordance with Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide Shop Drawings, parts lists, specifications and manufacturer's maintenance bulletins for each piece of equipment.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of athletic equipment from a single manufacturer with resources to provide materials of consistent quality in appearance and physical properties without delaying the work.

1.6 GUARANTEES

- A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities that manufacturers and Contractor may have by law or by other provisions of the Contract Documents.
- C. Upon receipt of notice from the Owner of failure of any part of the equipment during the guarantee period, the affected part or parts shall be replaced.
- D. Furnish, before final payment is made, a written guarantee covering the above requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. Basketball backstops, wall padding, volleyball equipment, scoreboards and shot clocks:
 - a. Draper, Inc.
 - b. Performance Sports Systems.
 - c. Porter Athletic Equipment Company.
 - d. Approved equal.
 - 2. Gymnasium Divider Curtains:
 - a. Draper Inc.
 - b. Institutional Products Inc.
 - c. Performance Sports Systems.
 - d. Porter Athletic Equipment Company.
 - e. Approved equal.
 - 3. Basketball scoreboards and shot clocks:
 - a. Porter Athletic Equipment Company.
 - b. Sportable Scoreboards
 - c. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Porter Athletic Equipment Company, to establish the general character and materials required for athletic equipment for this project. Equivalent products by acceptable manufacturers will be approved.

2.2 MOTORIZED FORWARD-FOLDING BACKSTOPS

- A. General: Ceiling suspended, forward-fold, front-braced, motorized basketball backstop with adjustable goal height and rectangular glass backboard. Refer to Drawings for locations.
 - 1. System: Steel pipe component assembly, regulation bank, official goal with a no-tie net, and a motorized safety hoist.
 - 2. Support: Each backstop shall be suspended from 3-1/2" o.d. or heavier steel pipe to provide

- the required support and span available structural steel. Overhead members spanning more than 16 feet shall be bridged or reinforced according to manufacturer's engineering instructions. Basketball backboard supports shall be painted a custom off-white color as selected by Architect to match building structure.
3. Backstops shall be operable on the swing-up principle, storing in minimal area when not in use.
 4. Quantity: 6 units.
- B. Product: Porter Athletic Equipment Company, *Model 90949-000*, or equal by approved manufacturer.
- C. Materials:
1. Fittings: Certified malleable iron castings or heavy gauge steel stampings.
 2. Pipe: Certified wrought iron or heavy gauge steel meeting ASTM A513.
 3. Factory Finish: Universal primer compatible with high-performance coating to be applied in the field.
- D. Hoisting Equipment:
1. Cable: 1/4" diameter 7 x 19 aircraft cable with a breaking strength of 7,000 lbs.
 2. Pulleys: Swivel and fixed pulleys shall be machined and polished steel 3" diameter x 1" wide complete with 1/2" diameter self-lubricating bronze oilite bushings. Pulley holders shall be fully enclosed providing a fail-safe system that will capture and retain the hoist cable.
 3. Safety Strap: Nylon webbing safety strap to prevent accidental drop of backboard from "up" position.
 - a. Strap shall be rated to withstand 1,000 lb. free fall load.
 - b. Product: Porter Athletic Equipment Company, *Model No. 797 Saf-Strap* or equal by backstop manufacturer.
- E. Frame:
1. Main Vertical Mast: 6 5/8" o.d. steel pipe. Mast shall be offset 4" for positive locking.
 2. Bracing: Anti-sway braces shall be rectangular 2 1/2" x 1 1/2" steel bracing welded to mast to form a unitized frame. Backstop shall have a rigid hinged front brace of 1-7/8" o.d. pipe designed to jack knife when closing.
 3. The entire assembly shall be self-aligning in the down position and self-releasing at the beginning of the folding cycle.
- F. Backboards:
1. Dimensions: Official 3'-6" x 6'-0" rectangular.
 2. Material:
 - a. Backboard: Fully tempered glass, 1/2" thick with extruded aluminum frame.
 - b. Markings: Backboard border and center target shall be fired into glass with brilliant white vitreous enamel.
 3. Frame: Welded, unitized construction fabricated from heavy wall rectangular steel tubing.
 4. Product: Porter Athletic Equipment Company, *Model 00208-000 Center-Strut Mount Rectangular Glass Backboard*, or equal by manufacturer of backstop.
- G. Padding:
1. Type: Bolt-on, molded profile with steel attachment channels; self-aligning with interlocking joints; provide square molded corners and lengths to cover entire bottom edge and lower portions of side edges.
 2. Material: 1-1/2" thick x 2" wide shock absorbing vinyl or neoprene foam pad with durable integral skin, in color as selected by Architect from manufacturer's standard range.
 3. Product: Porter Athletic Equipment Company, *Model 00326-00 Pro-Pad Backboard Padding Kit*, or equal by manufacturer of backstop.

- H. Goal: Positive lock, movable rim goal with pressure release mechanism.
 - 1. Rim: 5/8" diameter cold drawn alloy steel, round formed to 18" diameter ring, with integral net attachment system; epoxy paint finish.
 - 2. Pressure Release Mechanism: Adjustable, positive lock, pressure release mechanisms to provide rebound characteristics identical to those of a non-movable ring.
 - 3. Mounting: Rigid steel bracing, welded in position.
 - 4. Net: Anti-whip net.
 - 5. Product: Porter Athletic Equipment Company, *Model 00245-500 Ultra-Flex Goal*, or equal by manufacturer of backstop

- I. Motorized Winch: Worm gear type, 3/4 horsepower electric winch designed to hold backstop at any position when raising or lowering.
 - 1. Materials:
 - a. Winch housing, base, cable drum and bracket: Machined from high strength aluminum alloy.
 - b. Worm: High strain tempered steel bar.
 - c. Worm gear: Machined from high strength forged bronze alloy.
 - 2. Hoisting Capacity: 1200 pounds.
 - 3. Electrical Characteristics: 3/4 horsepower, 60 cycle, 115 volt, single phase electric motor with automatic thermal overload protection, manufactured to MEMA specifications.
 - 4. Power Connections: 6'-0" long SJO cord with twist-lock type plug and 4-pole twist-lock receptacle.
 - 5. Product: Porter Athletic Equipment Company, *Model No. 00706-000 3/4 H.P. Electric Winch*, or equal by manufacturer of backstop.

- J. Control Switch for Motorized Winch: Flush, wall-mounted key switch with separate up and down keys. Product: Porter Athletic Equipment Company, No. 791 Key Switch Control System for Electric Winches.

- K. Accessories: Provide all fastenings and other accessories as required for a fully functioning back-stop installation.

2.3 WALL PADDING

- A. General: Fire-retardant wall padding with 1" nailing margins for attachment to walls.
 - 1. Overall dimensions of each pad: 2'-0" (610 mm) wide by 6'-0" (1.9 m) high.

- B. Core: 1-1/2" thick fire-retardant, open cell neoprene foam filler bonded to 7/16" oriented strand wood board.
 - 1. Density: 5.5 lb/cubic foot.
 - 2. Indentation Force Deflection: 25-45 lb.

- C. Cover: 14-ounce non-tear vinyl laminated industrial polyester.
 - 1. Vinyl facing material shall be mildew and rot resistant.
 - 2. Covering shall be flame retardant with a rating according to ASTM E-84 as follows:
 - a. Class: A.
 - b. Flame spread: 0-25.
 - c. Smoke development: 0-450.
 - 3. Color: As selected by the Architect from manufacturer's standard colors.

- D. Fabrication:
 - 1. The fabric shall be placed over the filler, folded and blind stitched.
 - 2. Provide a 1-inch or greater width edging at the top and fitted with non-corroding grommets

- 12" o.c. reinforced for securing pads to wall.
 3. Pads shall be reversible.
- E. Accessories:
1. Provide suitable wall attachment clips, hooks or other such devices as approved by the Architect.
 2. 1 x 2 solid wood top and bottom trim to conceal fasteners in wall.
 - a. Species: Cherry, transparent finished.
 3. Molded Inserts: Fire-retardant, molded inserts designed to accommodate pad thickness specified, in size to fit electrical receptacles and switch plates indicated on Drawings.
 - a. Product: Porter Athletic Equipment Company, *Model No. 00342-124 Double-Gang/Graphite*, or equal by manufacturer of padding.
- F. Product: Porter Athletic Equipment Company, *Model No. 00345-2XX FR-Safpad Certified Fire-Retardant Wall Padding*, or equal by approved manufacturer.

2.4 VOLLEYBALL EQUIPMENT

- A. Volleyball Standards: Three pairs of rigid-braced, telescoping, sleeve type volleyball standards with adjustable height net attachment.
1. Poles: Aluminum pole uprights, for installation in floor sleeves, constructed as follows:
 - a. Material: Extruded high-strength, lightweight aluminum, 6063T alloy.
 - b. Finish: Clear anodized.
 - c. Bottom upright: 3-1/2-inch (89 mm) diameter, with foot designed to protect finished floor when moving standards.
 - d. Upper telescoping upright: Infinitely adjustable upright with integral pulley.
 2. Height Markings: Labels designating "Boys'/Men's", "Girls'/Women's" and "12 Years and Under" height settings.
 3. Pads: Two pairs of protective pads to fit specified uprights.
 - a. Product: Porter Athletic Equipment Company, *Model 00839-003* or equal by manufacturer of volleyball standards.
 4. Winch: Tensioning winch incorporating a heavy-duty, self-locking ratchet mechanism with a compression, disc-brake type release mechanism.
 - a. Product: Porter Athletic Equipment Company, *Model 00026-000 Powr-Winch* or equal by manufacturer of volleyball standards.
- B. Net: Regulation 32'-0" x 39" net.
1. Include all rigging and attachment devices.
 2. Product: Porter Athletic Equipment Company, *Model 02295-640 Powr-Line Volleyball Net* or equal by manufacturer of volleyball standards.
- C. Floor Inserts: Furnish floor sleeves with cover plate assemblies designed by manufacturer of volleyball standards for installation in raised athletic wood flooring system. Refer to Drawings for locations.
1. Cover Assembly: Brass cover plate flush with surface of flooring, secured to floor sleeve collar by swivel hinge and lock.
 2. Sleeve: 9-inch (229 mm) long brass sleeve with diameter to fit 3-1/2" diameter pole.
 3. Product: Porter Athletic Equipment Company, *Model 00870-200* or equal by approved manufacturer.
- D. Product: Porter Athletic Equipment Company, *Model No. 01991-000 Powr-Line International Competition Volleyball Standards (Pair)*, or equal by approved manufacturer.

2.5 GYMNASIUM DIVIDER CURTAINS

- A. Gymnasium Divider Curtains: Manually operated, one-way traversing (not parting) draw curtain, and as follows:
- B. Upper Curtain, Mesh: Woven fabric of 100 percent polyester yarn coated with PVC weighing not less than 6.5 oz./sq. yd (220 g/sq. m).
 - 1. Mesh Color: As selected by Architect from manufacturer's full range.
- C. Lower Curtain, Solid: Woven polyester coated with PVC, 18 oz./sq. yd (610 g/sq. m), embossed, 8-foot (2.4-m) height above floor.
 - 1. Fabric Color(s): As selected by Architect from manufacturer's full range for one color.
- D. Gymnasium Divider Curtain Flame-Resistance Ratings: Passes NFPA 701, inherently and permanently flame resistant.
 - 1. Permanently attach label to each fabric of curtain assembly indicating whether fabric is inherently and permanently flame resistant or treated with flame-retardant chemicals, and whether it will require retreatment after designated time period or cleaning.
- E. Curtain Fabrication: Fused seams and the following:
 - 1. Top Hem: Reinforce with double thickness mesh for continuous pipe batten.
 - 2. Bottom Hems for Roll-up Curtains: Floor-length curtains with hems 2 inches (50 mm) above finished floor and with manufacturer's standard 3-1/2- to 4-inch- (89- to 102-mm) roll-up tube and lifting tape.
- F. Accessories:
 - 1. Mounting hardware and framing: Provide low profile type framing and attachment hardware. Refer to Architectural drawings for details.
 - 2. Curtain Battens: Fabricate battens from steel pipe with a minimum number of joints. As necessary for required lengths, connect pipe with drive-fit pipe sleeve not less than 18 inches (450 mm) long, and secure with 4 flush rivets, plug welds, threaded couplings, or another equally secure method. Shop-paint completed pipe battens with black paint.
 - a. Steel Pipe: ASTM A 53/ A 53M, Grade A, standard weight (Schedule 40), black, 1-1/2-inch (40-mm) nominal diameter, unless otherwise indicated.
- G. Gymnasium Divider Curtain Operator: One-way traversing, draw type. Provide all accessories as required for a fully functioning draw curtain.

2.6 SCOREBOARDS AND SHOT CLOCKS

- A. General: Scoreboard and shot clocks shall meet requirements for FCC Class A.
 - 1. Provide two scoreboards and two shot clocks in Gymnasium.
- B. Basketball Scoreboard: Standard electronic scoreboard with LED displays controlled by wireless remote control system.
 - 1. General:
 - a. Enclosure: 18-gauge galvanized steel cabinet with black powder-coat finish
 - b. Overall Dimensions: 4'-0" (1.2 m) tall by 8'-0" (2.4 m) long by 8 inches (203 mm) deep.

2. Display:
 - a. Digits: 100,000 hour-rated, LED digits, minimum 15 inches (381 mm) high,
 - b. Dots and Arrows: 100,000 hour-rated, LED circular or triangular shapes, 3 inches (76 mm) high.
 - c. Captions: Vinyl lettering to identify each type of information.
 3. Information displayed: Scoreboard shall display the following information:
 - a. Three-digit HOME score; red LED
 - b. Three-digit GUEST score; red LED
 - c. One-digit PERIOD; orange LED
 - d. Home and Guest BONUS circular dots; red LED
 - e. Home and Guest POSSESSION arrows; red LED
 - f. Four-digit count-down CLOCK; orange LED
 4. Product: Porter Athletic Equipment Company, *Model 82022-301 Basketball Scoreboard with 15" LED Displays*, or equal by approved manufacturer.
- C. Shot Clocks
1. General:
 - a. Enclosure: 18-gauge galvanized steel cabinet with powder-coat finish
 - b. Overall Dimensions: 2'-0" (610 mm) tall by 2'-0" (610 mm) long by 8 inches (203 mm) deep.
 - c. Quantity: Two shot clocks for each scoreboard.
 2. Display: 100,000 hour-rated, LED digits, 13 inches (330 mm) high,
 3. Information displayed: Scoreboard shall display the following information: Two-digit count-down CLOCK; orange LED
 4. Product: Porter Athletic Equipment Company, *Model 82022-001 Shot Clocks* or equal by approved manufacturer.
- D. Remote Control for Scoreboard and Shot Clocks: Manufacturer's standard wireless system comprising the following:
1. Controller: Universal LCD keyboard controller, with nine keypad inserts for basketball and volleyball.
 2. Transformer: 12-volt DC wall transformer
 3. Transmitter: FCC Part 15-certific, 2.4 GHz transmitter connected to keyboard
 4. Receiver: 2.4 GHz receiver, in conformance with the requirements of FCC Part 15, connected to scoreboard.
- E. Power Requirements:
1. Scoreboard: Hard-wired into 20-amp, 120-volt, 60-Hz grounded AC circuit.
 2. Shot Clock: Hard-wired into 20-amp, 120-volt, 60-Hz grounded AC circuit
 3. Keyboard: Plug-in to receptacle on 20-amp, 120-volt, 60-Hz grounded AC circuit.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Examine space in which specified work is to be installed to assure the conditions are satisfactory for the installation of backstop work. Report in writing to the Contractor, any unsatisfactory conditions affecting work of this Section. Commencement of work shall be construed as acceptance of conditions.
- B. Obtain and verify all measurements and conditions on the job, and assume all responsibility for correctness of conditions prior to commencement of installation.
- C. Become familiar with all building conditions to coordinate installation of backstops with ductwork, lighting and structural steel. Refer to related drawings for other trades.

3.2 INSTALLATION OF BACKSTOPS

- A. Modify superstructure as required and provide new fittings. Frames shall remain securely and permanently attached to building construction. Attach new backboards and goals in strict accordance with manufacturer's instructions.
- B. Coordinate installation with the work of Section 260000 – Electrical, for power supply and completion of the keyswitch controls for backstops.

3.3 INSTALLATION OF WALL PADDING

- A. Install wall padding on walls where shown on Drawings, in accordance with manufacturer's instructions.
- B. Field cut all cutouts in pads as required to preserve access to wall-mounted electrical devices and other wall-mounted items.
- C. Notch the back of panels as required to cover pilasters and corners.

3.4 INSTALLATION OF VOLLEYBALL EQUIPMENT

- A. Furnish floor inserts for volleyball standards to the Contractor for installation under Section 096460 – WOOD ATHLETIC FLOORING.
- B. Install standards in strict accordance with manufacturer's instructions.
- C. Distance between volleyball standards shall be approximately 35'-0".

3.5 INSTALLATION OF GYMNASIUM DIVIDER CURTAIN

- A. Install curtain in strict accordance with manufacturer's instructions.
- B. Mount curtain from overhead structure as indicated on drawings, using low profile supports and framing as recommended by manufacturer.

3.6 INSTALLATION OF SCOREBOARDS AND SHOT CLOCKS

- A. Install scoreboards and shot clocks in strict accordance with manufacturer's instructions.
- B. Mount enclosures to substrate as indicated, using type and quantity of fasteners recommended by manufacturer for substrate.
- C. Coordinate installation with the work of Section 260000 – Electrical, for power supply and wiring for the remote control system.

3.7 TESTING AND DEMONSTRATION

- A. General: Test all electrically operated athletic equipment to verify its proper operation. Demonstrate operation to Owner in accordance with Division 1 - Closeout Procedures.

3.8 CLEANING UP

- A. All debris and surplus materials resulting from backstop modification and installation work shall be removed promptly as work progresses to a location indicated by the Contractor.
- B. Following completion, and before Substantial Completion, lubricate and clean finished surfaces in accordance with the manufacturer's instructions, and leave work free of imperfections.

3.9 PROTECTION OF WORK

- A. Protect work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work during installation. Damaged work shall be repaired or replaced as determined by the Architect.

END OF SECTION

SECTION 122400

SHADES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roller shades for both manual and motorized shade operators.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 061000 - ROUGH CARPENTRY for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Division 26 - ELECTRICAL for electrical service and connections for motor operators, controls, limit switches, and other powered devices and for system disconnect switches for motorized shade operation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
 - 1. Motorized Shade Operators: Include operating instructions.
 - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
 - 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018113.
 - 2. Show installed costs for all items listed.

- C. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.
 - 1. Motorized Shade Operators: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
 - 2. Wiring Diagrams: Power, system, and control wiring.
 - D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling suspension system members and attachment to building structure.
 - 2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
 - 3. Shade mounting assembly and attachment.
 - 4. Size and location of access to shade operator, motor, and adjustable components.
 - 5. Minimum Drawing Scale: 1/4 inch = 1 foot.
 - E. Samples for Initial Selection: For each colored component of each type of shade indicated.
 - 1. Include similar Samples of accessories involving color selection.
 - F. Samples for Verification:
 - 1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
 - 2. For the following products:
 - a. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
 - G. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
 - H. Product Certificates: For each type of roller shade, signed by product manufacturer.
 - I. Qualification Data: For Installer.
 - J. Product Test Reports: For each type of roller shade.
 - K. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining roller shades and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
 - 3. Operating hardware.
 - 4. Motorized shade operator.
- 1.4 QUALITY ASSURANCE
- A. Installer Qualifications: Fabricator of products.
 - B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

- C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 - 1. Flame-Resistance Ratings: Passes NFPA 701.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Mockups: Build a full size mockup 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.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Rollers Shades: Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas.
 - 3. Lutron Electronics Co., Inc..
 - 4. MechoShade Systems, Inc.

5. Nysan Shading Systems Ltd.
 6. Approved equal.
- B. Shade Schedule:
1. WS-1 Manually operated, single shade, room darkening.
 2. WS-2 Manually operated, dual shade, room darkening and blackout.
 3. WS-3 Motorized operated, single shade, room darkening.
- C. Shade Band Material: PVC-coated fiberglass
1. Colors: As selected by Architect from manufacturer's full range.
 2. Material Openness Factor: 5% for solar control shades (unless directed otherwise), and opaque for black-out shades.
 3. Bottom Hem: Straight
 4. Product: Provide series 5300 Euroveil for solar control shades and series 0700 Blackout for black-out shades as manufactured by Mechoshade Systems Inc., or approved equal.
- D. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material.
- E. Direction of Roll: Regular, from back of roller
- F. Mounting Brackets: Galvanized or zinc-plated steel.
- G. Bottom Bar: Steel or extruded aluminum. Provide exposed bottom bar with seal as required for smooth, properly balanced shade operation.
- H. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
- I. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.
- J. Shade Operation: Chain operator.
- K. Jamb Channels: Provide channels from shade manufacturer for mounting to jambs of openings.
- 2.2 ROLLER SHADE FABRICATION
- A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
1. Lifting Mechanism: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 1/4 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.
 2. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.
- E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.
- F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

2.3 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.

2.4 MOTORIZED ROLLER SHADE OPERATORS

- A. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.
- B. Comply with NFPA 70.
- C. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6 with NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
- D. Electric Motors: UL-approved or -recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
 2. Motor Characteristics: Single phase, 220 V, 60 Hz.
 3. Motor Mounting: Within manufacturer's standard roller enclosure.

- E. Position of Motor and Electrical Connection: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
- F. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following devices for remote-control activation of shades:
 - 1. Control Stations: Keyed, maintained-contact, three-position, switch-operated control station with open, close, and off functions. Provide two keys per station.
 - a. Color: White.
 - 2. Group Control Stations: Maintained-contact, three-position, rocker-style, wall switch-operated control station with open, close, and center off functions for single-switch group control.
 - a. Color: White
 - 3. Microprocessor Controls: Electronic programmable means for setting, changing, and adjusting control features. Provide unit isolated from voltage spikes and surges.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.
- H. Operating Function: Stop and hold shade at any position
- I. Operating Features: Include the following:
 - 1. Group switching with integrated switch control; single face plate for multiple switch cut-outs.
 - 2. Capable of interface with audiovisual control system.
 - 3. Capable of accepting input from building automation control system.
 - 4. Override switch.
 - 5. Backup gear and crank operator for manual operation during power failures with detachable handle, length required to make operation convenient from floor level.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Connections: Connect motorized operators to building electrical system.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to DIVISION 1 - GENERAL REQUIREMENTS, Contract Closeout.

END OF SECTION

SECTION 123551

MUSIC CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Provide Music Instrument and Robe and Uniform Storage Casework.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1). Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
- D. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
- E. Warranty: Submit manufacturer's standard warranty. Include labor and materials to repair or replace defective materials.
- F. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, including operating instructions, list of spare parts and maintenance schedule.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Music education storage casework design is based upon products of the manufacturer listed below. Provide basis of design product or approved comparable product. Comply with requirements of Part 1 Quality Assurance Article for approval of products not named below.

- 1. Wenger Corporation, Owatonna, MN; Telephone(800)4WENGER (800-493-6437); Email: info@wengercorp.com; Website: www.wengercorp.com.

2.2 MATERIALS

- A. Particleboard Thermoset Panels: Particleboard finished with thermally-fused polyester surfacing on both sides meeting performance properties of NEMA LD 3 for VGS grade, edge-banded, including the following:
 - 1. Surface Abrasion Resistance: Taber Wheel, 400 cycles, for solid colors.
- B. Polyethylene Shelves: High-density, one-piece, blow-molded or polyethylene, with radiused front edge, for abuse-resistant shelves.
- C. PVC Edge Banding: Radiused PVC extrusions, 3 mm thick.

2.3 INSTRUMENT AND ROBE/UNIFORM STORAGE CASEWORK

- A. General: Provide through-ventilating instrument storage casework.
- B. Side Panels and Divider Panels: Particleboard thermoset panel, 3/4 inch (19 mm) thick. Side panels machined to accept unit-to-unit through-bolting.
- C. Panel Doors: Particleboard thermoset panel, 3/4 inch (19 mm) thick, inset-type. Color: **[Oyster]** **[Maple]** **[Pebble]** **[Cherry]** **[Evening Tigris]** **[Fusion Maple]** **[Solar Oak]** **[As scheduled]**. Mixed door finishes as shown on the drawings.
 - 1. Provide for **[Instrument Storage Casework, full height]** **[Instrument Storage Casework, compartment height]** **[Robe and Uniform Storage Casework]****[casework indicated]**.
- D. Panel Edge Banding: 3 mm thick, heat-bonded, with radiused and profiled edges and corners.
- E. Shelving: Sized with adequate gap between shelving and casework side panels to allow air movement inside casework.
 - 1. Up to 27 inches (686 mm) wide: Removable molded polyethylene shelf, with impact-resistant, radiused front edge, mounted to cabinet wall with self-locking clip.
 - 2. Over 27 inches (686 mm) wide: For large instrument casework: Removable formed polyethylene shelf, ribbed, with high-impact-resistant, radiused front edge, supported by steel tube frame.
- F. Flag Storage and Garment Ring: 5/16 inch (8 mm) diameter steel rod bolted to steel center post with 10 gauge steel brackets.
- G. Flag Storage Bottom Shelf Pad: Carpet pad, adhered to steel shelf.
- H. Casework Panel Color: As selected by Architect from manufacturer's standard colors.

2.4 ACCESSORIES

- A. Filler Panels and Closure Kits: 3/4 inch (19 mm) thick particleboard thermoset panels matching cabinet side panels. Provide the following, cut to fit field conditions, where indicated:
 - 1. Wall filler between cabinet side and wall.
 - 2. Top filler between cabinet top and wall.
 - 3. Top of cabinet closure panel between cabinet and finished ceiling or soffits.

2.5 HARDWARE

- A. Butt Hinges: 2-3/4 inch (70 mm), 5-knuckle steel hinges made from 0.090 inch (2.29 mm) thick metal, ANSI/BHMA A156.9, Grade 1, with powder-coated finish, through-bolted to door and side

panels. Provide 2 hinges on compartment doors, and 4 hinges on full-height doors.

- B. Slide Latch: 0.105 inch (2.67 mm) min. thickness steel, with padlock eye, powder-coat finish, through-bolted to panel door and side panel Latches securely without padlock. Provide with clear plastic label holder with numbering system. Padlocks furnished by Owner.
- C. Panel Connectors: 1/4–20 by 1.77 inch (45 mm) panel connectors, with steel thread inserts, powder coated to match panels.
- D. Cabinet Levelers: Leveling glides with 3/8 inch (9.5 mm) diameter threaded steel rod in steel corner brackets, minimum two each per cabinet side, accessible from within unit, and concealed in completed installation.
- E. Fasteners: Manufacturer-recommended fasteners as required for casework substrate and project performance requirements, consisting of one or more of the following:
 - 1. Sheet Metal Screws: SAE J78, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
 - 2. Wood Screws: ASME B18.6.1.
 - 3. Expansion Anchors in Concrete and Concrete Masonry Units: Carbon-steel, zinc plated.

2.6 FINISHES

- A. Steel Sheet, Steel Wire, and Exposed Fasteners: Urethane-based electrostatic powder coating, color as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- B. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION

omr architects inc.
AUGUST 15, 2012

CONCORD CARLISLE HIGH SCHOOL
CONCORD, MA

SECTION 124810

ENTRANCE FLOOR MATS AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Roll-up aluminum-tread rail floor mats with aluminum hinges.
 - 2. Loop filament matting.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete work, including forming, placing, and finishing concrete floor slabs, and for concrete materials for grouting and filling around and under recessed mats and frames.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show the following:
 - 1. Items penetrating floor mats and frames, including door control devices.
 - 2. Divisions between mat sections.
 - 3. Perimeter floor moldings.
- D. Samples for Initial Selection: For each type of product indicated.
 - 1. Floor Mat: 12-inch- square, assembled sections of floor mat.
 - 2. Frame Members: 12-inch- long Sample of each type and color.

- E. Maintenance Data: For floor mat[and frames to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain floor mats and frames through one source from a single manufacturer.
- B. Accessibility Requirements: Provide installed floor mats that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), [Accessibility Guidelines for Buildings and Facilities \(ADAAG\)](#)" and the [Massachusetts Architectural Access Board](#).

1.5 PROJECT CONDITIONS

- A. Field Measurements: Indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. Coordinate size and location of recesses in concrete with installation of finish floors to receive floor mats and frames.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Roll-up Aluminum Rail Hinged Mats:
 - a. AFCO-USA.
 - b. Balco, Inc.
 - c. Construction Specialties, Inc.
 - d. Mats Incorporated.
 - e. Musson, R. C. Rubber Co. (The).
 - 2. Loop Filament Matting:
 - a. AFCO-USA.
 - b. Mats Incorporated.
 - c. Tennessee Mat Company, Inc.

2.2 METAL FRAME MATERIALS

- A. Extruded Aluminum: ASTM B 221 alloy 6061-T6 or alloy 6063-T5, T6, or T52 as standard with manufacturer.

2.3 CONCRETE FILL AND GROUT MATERIALS

- A. Provide concrete materials complying with Section 033000 - CAST-IN-PLACE CONCRETE for grout and fill around and under recessed mats and frames that produce concrete equivalent in strength to cast-in-place concrete slabs. For concrete fill, adjust aggregate size to not exceed one-third fill thickness.

2.4 FLOOR MATS

- A. General: Provide colors, patterns, and profiles of materials, including metals and metal finishes indicated or specified. If not indicated, provide colors, patterns, and profiles selected by Architect from manufacturer's standards.
- B. Roll-up Aluminum Rail Hinged Mats: Clear-anodized finish, extruded-aluminum tread rails sitting on continuous vinyl cushions with 1-1/2-inch-wide by 3/8-inch-thick, tread rail modules. Provide aluminum hinges and 28-oz./sq. yd. weight, level-cut, nylon-pile, fusion-bonded carpet tread inserts].
 - 1. Tapered Rigid Frame: Tapered extruded-aluminum frame members, not less than 1-1/2 inches wide, with mitered corners and finish to match tread-slat extrusions.
- C. Loop Filament Matting: 3M's "Nomad" loop filament vinyl material 3/8 inch thick, with solid vinyl sheet backing and built-in chemical agents to reduce fungus and mildew. Provide color specified or scheduled or, if not specified or scheduled, as selected by Architect.
 - 1. Flexible Edging: 2-inch-minimum, vinyl edge strip in matching color, bonded to each end of mat material or backing sheet.

2.5 FABRICATION

- A. General: Where possible, verify sizes by field measurement before shop fabrication.
- B. Floor Mats: Shop fabricate units to greatest extent possible in sizes as indicated. If not otherwise indicated, provide single unit for each mat installation; do not exceed manufacturer's recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in mats are necessary, space symmetrically and away from normal traffic lanes. Miter corner joints in framing elements with hairline joints or provide prefabricated corner units without joints.
- C. Recessed Metal Mat Frames: Extruded aluminum of size and style to fit floor mat type specified, for permanent recessed installation, complete with corner pins or reinforcement and anchorage devices.
 - 1. Fabricate edge-frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.
- D. With manufacturer's standard protective coating, coat surfaces of aluminum frames that will contact cementitious material.

2.6 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.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

- B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrate for compliance with requirements for location, sizes, minimum recess depth, and other conditions affecting installation of floor mats and frames.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install recessed mat frames to comply with manufacturer's written instructions. Set mat tops at height recommended by manufacturer for most effective cleaning action; coordinate top of mat surfaces with bottom of doors that swing across mats to provide clearance between door and mat.
 - 1. Install necessary shims, spacers, and anchorages for proper location and secure attachment of frames.
 - 2. Install grout and fill around frames and, if required to set mat tops at proper elevations, in recesses under mats. Finish grout and fill smooth and level.

3.3 PROTECTION

- A. After completing 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 Substantial Completion.
- B. Defer installation of floor mats until Project is near Substantial Completion.

END OF SECTION

SECTION 126100

FIXED AUDIENCE SEATING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Fixed floor mounted audience seating with folding seats.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Collaborative for High Performance Schools – Massachusetts (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 - 2. Refer to section 018119 - Indoor Air Quality Requirements for material and procedure requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fixed audience seating. Include electrical characteristics.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Seating Layout: Show seating layout, aisle widths, row-lettering and chair-numbering scheme, chair widths, and chair spacing in each row.
 - 2. Accessories: Show accessories, including locations of left- and right-hand tablet arms, electrical devices, accessibility provisions, and attachments to other work.
 - 3. Wiring Diagrams: For power, signal, and control wiring.
- C. Samples for Verification: Two standard size units, showing aisle and connection.
- D. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
 - 1. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018113.
 - 2. Show percentage of product that is FSC-certified wood. Provide backup documentation as described in Section 018113.
 - 3. Show installed costs for all items listed.

- E. Product Certificates: For each type of flame-retardant treatment of fabric, from manufacturer.
- F. Field quality-control reports.
- G. Maintenance Data: For fixed audience seating to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining upholstery fabric.
 - 2. Precautions for cleaning materials and methods that could be detrimental to seating finishes and performance.
- H. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of seating required, including accessories and mounting components, from single source from single manufacturer.
 - 1. Upholstery Fabric: Obtain fabric of a single dye lot for each color and pattern of fabric required.
- B. Fire-Test-Response Characteristics of Upholstered Chairs:
 - 1. Fabric: Class 1 according to DOC CS 191 and 16 CFR 1610.61, tested according to California Technical Bulletin 117.
 - 2. Padding: Comply with California Technical Bulletin 117.
 - 3. Full-Scale Fire Test: Comply with California Technical Bulletin 133.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install seating until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of seating layout and construction contiguous with seating by field measurements before fabrication.

1.6 COORDINATION

- A. Coordinate layout and installation of electrical wiring and devices with seating layout to ensure that floor junction boxes for electrical devices are accurately located to allow connection without exposed conduit.
 - 1. Coordinate wiring and power receptacles installed in seating with requirements in Division 16 Sections.
 - 2. Coordinate wiring and data ports installed in seating with requirements in Division 16 Sections.
- B. Coordinate layout and installation of diffuser pedestals with HVAC work and with properties of diffuser pedestals to ensure alignment, proper air diffusion, and correct seat locations.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fixed audience seating that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures including standards, beams, and pedestals.
 - b. Wear and deterioration of fabric and stitching beyond normal use.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 2. Warranty Periods: As follows, from date of Substantial Completion.
 - a. Structural: 10 years.
 - b. Plastic, Wood, and Paint Components: Five years.

PART 2 - PRODUCTS

2.1 FIXED AUDIENCE SEATING

- A. Manufacturers:
1. KI, Concerto (Basis of Design).
 2. Irwin Seating Co., Millennium.
 3. Hussey Seating, Classic Series.
 4. Theater Solutions, Inc., Lyric D4.
 5. Approved equal.
- B. Components:
1. Back Panel: Plastic
 2. Back Foam: 2" [51mm]
 3. Seat Type: Standard cushion.
 4. Armrest Type: Wood
 5. Standards: Cast aluminum
 6. Chair Mount: Floor Mount
 7. End Panels: Wood.
- C. Product Description/Criteria:
1. Number of Chairs: As indicated on Drawings.
 2. Number of Rows: As indicated on Drawings.
 3. Number of Wheelchair Locations: As indicated on Drawings.
 4. Number of ADA Easy Access End Standards: at all wheelchair locations.
 5. Rise: As indicated.
 6. Fabric: C.O.M.; match Architect's sample.

2.2 MATERIALS, GENERAL

- A. Cast Aluminum: AA - 380
- B. Steel Tubing: ASTM A513

- C. Steel Sheet/Coil: ASTM A607
- D. Mechanical or Adhesive Concrete Anchors: SAE grade 2
- E. Exposed Hardwood Lumber: Wood Species: Maple.
- F. Concealed Plywood: Engineered Wood Association PS1-95 2000: Poplar
- G. Medium Density Fiberboard: ANSI A208-2-1986
- H. Plastic Laminate: NEMA LD3.1-1985, GP 48
- I. Polyurethane Foam Padding: ASTM D-3574
- J. Fabric: C.O.M.; match Architect's sample.
- K. Molded plastic: Injection Molded copolymer polypropylene or nylon 6/6.

2.3 FABRICATION

A. Upholstered Seats:

1. The seat assembly shall consist of a stylish padded and upholstered top surface, a polypropylene bottom shell with dual contours, and a dual sprung lifting mechanism. Seat shall have the ability to achieve a full fold position when rearward pressure is applied. Superior comfort shall be derived through careful ergonomic engineering.
2. Upholstery Pad: The upholstered seat topper shall consist of a 5/8" thick formed ply form base with contoured molded polyurethane foam padding and fabric upholstered cover. Seat padding shall be properly contoured to support the body without causing discomfort. The upholstered seat cover shall exhibit a high degree of tailoring and will be affixed to the base with upholstery staples.
3. Seat Mechanism: Seat lifting mechanism shall use lubricated lifting springs to provide whisper quiet fail-safe operation. The seat structure shall rotate on a 3/4" [19mm] spanner bar to assure shaft alignment and eliminate binding due to irregular floor conditions. Seats shall be certified to withstand 350,000 lifting cycles and a 600lb static load without failure.
4. Standard Bottom Cover: Seat shell/bottom shall be constructed of polypropylene plastic to provide a durable yet aesthetic design. The cover shall protect the mechanical parts of the lifting hinge and upholstered seat topper. The shell / bottom shape shall compliment the overall design of the chair.
5. Seat Cover Tailoring: Waterfall - Standard

B. Seat Back (Plastic Outer Back Cover)

1. The outer back panel shall be constructed of injection molded polypropylene Plastic. The panel shall be no less than 27" in length and conceal the rear and sides of the upholstered inner panel. The panel shall extend below the rear of the seat to protect the chair occupant's back.
2. The inner upholstered panel shall be 5/8" (15mm) 11 ply thick-formed hardwood with an ergonomically engineered contour. The wings for attachment of chair back to standard shall be not less than 14 ga (1.9mm) and will be attached via concealed fasteners. Wings shall position the chair back at one of three positions: 15, 18, or 21 degrees. There shall be no exposed fasteners above the seat. Chair back upholstery shall exhibit a high degree of workmanship and customization.

- a. Soft Square - 33": The top corners of the back are conically shaped for stylish looks and a timeless appearance. Overall back height is 33" above the floor allowing proper shoulder support of the chair occupant. The back surface shall be compound contoured to facilitate proper posture of a seated individual.
 3. BACK FOAM TYPE. 2"(51mm)cut
 4. BACK COVER TAILORING. Waterfall Standard
- C. Cast Aluminum Standards:
1. Standards shall be die cast Aluminum AA380 grade.
 2. Standards shall be floor attached, designed to maintain a constant seat height to floor.
 3. Cast Aluminum Standards shall be an integral aesthetic part of the chair's appearance and do not require the use of end panels.
- D. Seat Hinges:
1. Seat hinges shall be fully contained within the seat pan and fitted with a pair of independent, permanently lubricated bearings.
 2. Each of the independent seat hinges shall be fitted with double acting; self-centering, pre-loaded coiled seat return springs.
 3. Seat hinge and spring installation shall be designed not to require periodic adjustment or lubrication.
- E. Finish:
1. Finish for Steel / Aluminum Components: (Indoor) Material shall be pre-treated in an iron phosphate wash system prior to finish application. Finish shall be a specially blended polyester T.G.I.C./Epoxy powder coating with a minimum dry film thickness of 1.5 mils.
 2. Injection molded polypropylene or nylon: Shall be pigmented, in one of manufacturers standard colors and have a textured surface.
 3. Fabric: Upholstery material shall be 100% Marquesa Lana continuous filament Olefin yarn.
 4. Color: Shall be per manufacturer's standards. Seating Contractor shall submit color samples for owner's approval prior to manufacture.
- F. Armrests:
1. Provide solid wood armrests, select Maple, stained to match Architects sample. Armrest to be secured to standard with concealed fasteners.
- 2.4 FASTENINGS
- A. Chair Assembly
1. All welds shall be made at the factory by welders that are certified on the equipment and process used.
 2. All structural connections shall be made with S.A.E. stress rated zinc plated or, black oxide steel bolts, washers and nuts.
- B. Concrete Floor Attachment
1. Chair stanchions shall each be attached by means of two 3/8"[10mm] threaded rods secured into concrete with a fast curing acrylic adhesive. Adhesive and rods are set in holes drilled to a minimum depth of 2 1/2"[64mm] in the concrete.

2. Threaded rods shall be of approved type with zinc-plate finish or made of stainless steel to suit environmental conditions.
3. Acrylic Adhesive shall be in conformance with ASTM Type IV, Grade 3, and covered by ICBO evaluation.
4. Stanchion to be placed on the bolts, stanchions to be permanently secured with a flat washer, lock washer and nut.

2.5 ACCESSORIES

- A. Armrest, Easy Access: Armrest shall hinge on end standards to allow easy access for disabled patrons. Swing-up end arms shall be provided for one percent of fixed seating capacity to meet the Americans with Disabilities Act (ADA). Each accessible chair shall include the universal handicap symbol on the end aisle standard for clear identification.
- B. Standard Chair Numbers: Black text with gray background on a 23/32" x 2 7/32" [18.5mm x 56.5mm] elliptical Lexan plate. Plate fitted in a vandal resistant recess located in rear of armrest and secured with adhesive.
- C. Standard Row Letters: Black text with gray background on a 23/32" x 2 7/32" [18.5mm x 56.5mm] elliptical Lexan plate. Plate fitted in a vandal resistant recess located in rear of armrest and secured with adhesive.
- D. Removable Chairs: Provide chairs to be floor mounted and ganged in groups of one, two, or three chair units for easy removal. Chair standards shall be mounted to a painted steel skid base. Skid base with chairs shall be easily removed from the concrete floor by means of flush mounted internally threaded expansion anchors positioned under each leg of the skid. When removed, the anchor holes are filled by flat head bolts to provide a flat surface and prevent dirt and debris from entering.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine floors, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Examine locations of HVAC supply ducts.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.
 1. Use installation methods and fasteners that produce fixed audience seating assemblies with individual chairs capable of supporting an evenly distributed 600-lb static load without failure or other conditions that might impair the chair's usefulness.
 2. Install standards and pedestals plumb.

- B. Install seating with chair end standards aligned from first to last row and with backs and seats varied in width and spacing to optimize sightlines.
- C. Install chairs in curved rows at a smooth radius.
- D. Install seating so moving components operate smoothly and quietly.
- E. Install wiring conductors and cables concealed in components of seating and accessible for servicing.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust chair backs so that they are aligned with each other.
- B. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.
- C. Verify that all components and devices are operating properly.
- D. Verify that seating returns to correct at-rest position.
- E. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.
- F. Replace upholstery fabric damaged during installation.

END OF SECTION

SECTION 126610
TELESCOPING STANDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Wall-attached telescoping stands.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Division 26 - ELECTRICAL for electrical service for motor operators, controls, and other powered devices for motorized gymnasium dividers.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for telescoping stands.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Include wiring diagrams for electrically operated units.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Decking: 3-inch- square samples of finished material.
 - 2. Metal Components: 3-inch- square sample of each color and finish indicated.

3. Seating: 3-inch- square sample of each seating material, color, and finish indicated.

F. Qualification Data: For Installer.

G. Operation and Maintenance Data: For telescoping stands to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Manufacturer's Engineering Responsibility: Preparation of data for telescoping stands, including Shop Drawings, and comprehensive engineering analysis by a qualified professional engineer.

C. Safety Standard: Provide telescoping stands that comply with requirements in NFPA 102.

D. Welding: Qualify procedures and personnel according to AWS D1.1 "Structural Welding Code - Steel" and AWS D1.3 "Structural Welding Code - Sheet Steel."

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Accessibility Requirements: Provide telescoping stands that comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and local accessibility standards.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, and other construction that will interface with telescoping stands by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 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. Hussey Seating Company.
2. Interkal LLC.
3. Irwin Telescopic Seating (formerly Folding Bleacher) Company.

2.2 MATERIALS

A. Wood:

1. Lumber: Kiln-dried, surfaced four sides; southern pine complying with SPIB's "Standard Grading Rules for Southern Pine Lumber" for C&Btr Finish (C and better) grade-of-finish requirements.
2. Plywood: APA grade trademarked, DOC PS 1.

B. Steel:

1. Structural Steel Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating designation.
3. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold-rolled commercial steel), or ASTM A 1011/A 1011M, Designation CS (hot-rolled commercial steel).
4. Tubing: ASTM A 500, cold formed; ASTM A 501, hot formed; or ASTM A 513, mechanical.

C. Extruded Aluminum: ASTM B 221, alloy as standard for manufacturer.

D. Polyethylene Plastic: High-density polyethylene; molded, color-pigmented, textured, impact-resistant, structural formulation.

2.3 TELESCOPING STANDS

A. Description: Operable systems of multiple-tiered seating on interconnected folding platforms that close, without being dismantled, into a nested stack for storing or moving. Stand units permit opening and closing of adjacent rows, allow individual and collective rows to be locked open for use, and close with vertical faces of upper skirts on the same vertical plane.

B. Wall-Attached Telescoping Stands: Rear of understructure permanently attaches to wall construction.

1. Basis-of-Design Product: Hussey, Maxam Telescopic Gym Seat System.
2. Operation: Automatic, power assisted by portable, manually guided, electrically powered unit.
 - a. Limit Switches: Automatically stop integral power system when telescoping stands reach fully opened or closed positions.
 - b. Motion Monitor: Flashing light with self-contained warning horn, rated at 85 decibels (dB) at 10 feet, mounted under telescoping seating for audio and visual warning during integral power operation.
 - c. Transformer: As required to coordinate current characteristics of motor and control station with building electrical system.

C. Row Spacing: 22 inches.

D. Row Rise: 10 inches.

E. Bench Seats and Skirts:

1. Material: Molded polyethylene plastic with contour seat surface and end caps.
 - a. Colors: As selected by Architect from manufacturer's standard.
2. Bench Height: Not less than 16 inches or more than 18 inches.
3. Bench Depth: 10 inches.

F. Wheelchair-Accessible Seating: Locate cutouts to provide wheelchair-accessible seating at locations indicated on Drawings.

1. Equip tiers adjacent to wheelchair-accessible seating with front rails as required by referenced safety standard.
 2. Equip cutouts with full-width front closure panels that match decking construction and finish and that extend from underside of tiers adjacent to cutouts to 1-1/2 inches from finished floor.
- G. Deck: Plywood.
1. Finish: Manufacturer's standard finish.
- H. Risers: Steel sheet with manufacturer's standard rust-inhibiting coating or hot-dip galvanized finish.
- I. Rails: Structural steel or extruded aluminum, finished with manufacturer's standard powder coat system.
1. Color: Black.
- J. Understructure: Structural steel.
1. Finish: Manufacturer's standard rust-inhibiting finish.
 2. Color: Manufacturer's standard.
- K. Support Column Wheels: Nonmarring, soft, rubber-face wheel assembly under each support column.
1. Include wheels of size, number, and design required to support stands and operate smoothly without damaging the flooring surface, but not less than four per column or less than 3-1/2 inches in diameter and 1 inch wide.
- L. Aisle Closures: Manufacturer's standard that produce flush vertical face at aisles when system is stored.
- M. Fasteners: Vibration proof, in manufacturer's standard size and material.
- N. Accessories:
1. Slip-resistant, abrasive tread surfaces at vertical aisles.
 2. Intermediate aisle steps, fully enclosed, at each vertical aisle.
 3. Transitional top step, fully enclosed, at each vertical aisle where last row of telescoping stands is adjacent to a cross aisle.
 4. Removable front steps, fully enclosed, at each vertical aisle, that engage with front row to prevent accidental separation or movement and are equipped with a minimum of four skid-resistant feet.
 5. Folding, nonremovable mid-aisle handrails located at centerline of each vertical aisle with seating on both sides.
 6. End rails (guards) that are telescoping and self-storing.
 7. Back rails (guards) along rear of units where required by referenced safety standard.
 8. Front rails (guards) along front of units where required by referenced safety standard.
 9. Removable, programming-support front rails to allow seating in upper rows while lower rows remain in the stored position.
 10. Rear fillers including supports for closing openings between top row and rear wall of adjoining construction.
 11. Gap fillers for closing openings between stand units or between stand units and adjoining construction.

12. End panels covering exposed ends of stands in stored position.

2.4 FABRICATION

- A. Fabricate understructure from structural steel members in size, spacing, and form required to support design loads specified in referenced safety standard.
- B. Weld understructure to comply with applicable AWS standards.
- C. Round corners and edges of components and exposed fasteners to reduce snagging and pinching hazards.
- D. Form exposed sheet metal with flat, flush surfaces, level and true in line, and without cracking and grain separation.
- E. Seating Supports: Fabricate supports to withstand, without damage to components, the forces imposed by use of stands without failure or other conditions that might impair the usefulness of seating units.
 1. Cantilever bench seat supports to produce toe space uninterrupted by vertical bracing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where telescoping stands are to be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install telescoping stands to comply with referenced safety standard and manufacturer's written instructions.

3.3 ADJUSTING AND CLEANING

- A. On completion of installation, lubricate, test, and adjust each telescoping stand unit so that it operates according to manufacturer's written operating instructions.
- B. Clean installed telescoping stands on exposed and semiexposed surfaces. Touch up shop-applied finishes or replace components as required to restore damaged or soiled areas.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain telescoping stands. Refer to Division 01.

END OF SECTION

SECTION 140001

ELEVATORS

(Trade Bid Required)

Trade Contractors on this CM at Risk project are required by law to provide Payment and Performance Bonds for the full value of their Trade Contracts, and Trade Contractors must include the full cost of the required Payment and Performance Bonds in the Bid price they submit in response to this RFB.

Bids will only be accepted from Trade Contractors pre-qualified by the Awarding Authority.

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

B. Time, Manner and Requirements for Submitting Trade Bids:

1. Trade bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the _____ at a time and place as stipulated in the "NOTICE TO CONTRACTORS".

The following should appear on the upper left hand corner of the envelope:

NAME OF TRADE BIDDER: (Insert name of trade bidder)

MASS. STATE PROJECT: ((Insert project number from top of page))

TRADE BID FOR SECTION: 140001- ELEVATORS

2. Each trade bid submitted for work under this Section shall be on forms furnished by the _____ as required by Section 44F of Chapter 149 of the General Laws, as amended. Trade bid forms may be obtained at the office of the _____, or may be obtained by written or telephone request; telephone _____.
3. Trade bids filed with the _____ shall be accompanied by BID BOND or CASH or CERTIFIED CHECK or TREASURER'S CHECK or CASHIER'S CHECK issued by a responsible bank or trust company payable to the _____ in the amount of five percent of the trade bid. A trade bid accompanied by any other form of bid deposit than those specified will be rejected.

C. Trade Sub-Bid Requirements: Not Applicable

- D. Reference Drawings: The Work of this Trade Bid is shown on the following Contract Drawings:
((always insert accurate list of sheet numbers of applicable Drawings)).

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. All Work of Section 142100 – ELECTRIC TRACTION ELEVATORS
 - 2. All Work of Section 144200 – WHEELCHAIR LIFTS.

END OF SECTION

SECTION 142100

ELECTRIC TRACTION ELEVATORS

(Part of Work of Section 140001 - ELEVATORS, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Machine-room-less electric traction passenger elevators.
 - 2. Machine-room-less electric traction service elevators.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE:
 - a. Lintels, sleeves, anchors, inserts, plates and similar items for elevators.
 - 2. Section 042000 - UNIT MASONRY:
 - a. Elevator rail bracket inserts.
- D. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous framing and supports for hoisting machines, and for elevator door sills, cants in hoistways made from sheet steel, and elevator pit ladders.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING for the hoist beams, attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
 - 3. Division 26 - ELECTRICAL for telephone service to elevators.
 - 4. Division 26 - ELECTRICAL for electrical service for elevators to and including disconnect switches at machine room door and telephone wiring to elevator.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1 apply to work of this Section.

- B. Defective Elevator Work: Operation or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for the following:
 - 1. Car enclosures and hoistway entrances.
 - 2. Operation, control, and signal systems.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, equipment layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Include large-scale layout of car control station and standby power operation control panel. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
- D. Samples for Verification: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch-square Samples of sheet materials; and 4-inch lengths of running trim members.
- E. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- F. Qualification Data: For Installer.
- G. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
- H. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- I. Warranty: Special warranty specified in this Section.
- J. Continuing Maintenance Proposal: Service agreement specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain elevators through one source from a single manufacturer.
 - 1. Provide major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.
- C. Regulatory Requirements: Comply with ASME A17.1 and **Massachusetts Elevator Code**.

- D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), [Accessibility Guidelines for Buildings and Facilities \(ADAAG\)](#) and the [Massachusetts Architectural Access Board](#).
- E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging.
- B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

1.7 COORDINATION

- A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
- B. Coordinate sequence of elevator installation with other work to avoid delaying the Work.
- C. Coordinate locations and dimensions of other work relating to hydraulic elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
 - 1. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service 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 at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
 - 1. Include 24-hour-per-day, 7-day-per-week emergency callback service.
- B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electric traction elevators that may be incorporated into the Work include, but are not limited to, the following:
1. Fujitec America, Inc.
 2. KONE Inc.
 3. Otis Elevator Co.
 4. Schindler Elevator Corp.
 5. ThyssenKrupp Elevator.

2.2 PASSENGER ELEVATORS

- A. Elevator No.: 1

1. Type: Machine-room-less, gearless traction.
2. Rated Load: 3000 lb
3. Rated Speed: 150 fpm
4. Auxiliary Operations:
 - a. Standby power operation.
5. Car Enclosures: As follows:
 - a. Inside Width: As indicated on the Drawings.
 - b. Inside Depth: As indicated on the Drawings.
 - c. Inside Height: As indicated on the Drawings.
 - d. Front Walls: Satin stainless steel with integral car door frames.
 - e. Door Type: Two-speed side sliding, 42 inches wide.
 - f. Car Fixtures: Satin stainless steel.
 - g. Side and Rear Wall Panels: Plastic laminate.
 - h. Reveals: Satin stainless steel.
 - i. Door Faces (Interior): Satin stainless steel.
 - j. Door Sills: Aluminum.
 - k. Ceiling: Polished stainless steel.
 - l. Handrails: Satin stainless steel, at side and rear walls.
 - m. Floor prepared to receive carpet specified in Section 096820 - SHEET CARPETING.
 - n. Floor prepared to receive resilient flooring specified in Section 096520 - RESILIENT TILE FLOORING.
6. Hoistway Entrances: As follows:
 - a. Width: As indicated on the Drawings
 - b. Height: As indicated on the Drawings.
 - c. Door Type: Two-speed side sliding, 42 inches wide.
 - d. Frames: Satin stainless steel.
 - e. Doors: Satin stainless steel.
 - f. Sills: Aluminum.
7. Hall Fixtures: Satin stainless steel.
8. Additional Requirements: As follows:

- a. Provide inspection certificate in each car, mounted under acrylic cover with satin stainless-steel frame.
- b. Provide protective blanket hooks in all cars and two complete sets of full-height blankets.

2.3 SERVICE ELEVATORS

A. Elevator Nos.: 2

1. Type: Machine-room-less, gearless traction.
2. Rated Load: 5000 lb.
3. Rated Speed: 150 fpm.
4. Auxiliary Operations: Standby power operation.
5. Signal Equipment: Satin stainless steel, single-button hall stations with [position] ["In-Use"] indicator.
6. Car Enclosures: As follows:
 - a. Platform Width: As indicated on the Drawings.
 - b. Platform Depth: As indicated on the Drawings.
 - c. Ceiling Height: 96 inches
 - d. Walls and Ceiling: Satin stainless steel.
 - e. Floor: Rolled steel floor plate.
 - f. Door Type: Two speed side sliding, 48 inches wide.
 - g. Car Gate Operation: Power operated.
 - h. Car Gate Material: Satin stainless steel.
 - i. Car Sill: Steel angle.
 - j. Lighting: 48-inch suspended 2-tube fluorescent light fixtures with white reflectors.
7. Hoistway Entrances: As follows:
 - a. Width: As indicated on the Drawings.
 - b. Height: As indicated on the Drawings.
 - c. Door Type: Two-speed side sliding, 48 inches wide.
 - d. Door Operation: Power operated.
 - e. Door Material: Stainless] steel.
 - f. Sill supports specified in Section 055000 - METAL FABRICATIONS.
8. Additional Requirements: As follows:
 - a. Door reopening device.

2.4 SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.
- B. Elevator Machines: Provide variable-voltage, variable-frequency, ac-type or variable-voltage, dc-type hoisting machines. Provide solid-state power converters.
 1. Provide regenerative or nonregenerative system.
 2. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
 3. Provide means for absorbing regenerated power when elevator system is operating on standby power.

4. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
- C. Fluid for Oil Buffers: If oil buffers are used, use only fire-resistant hydraulic fluid containing antioxidant, anticorrosive, antifoaming, and metal-passivating additives.
 1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Hydro Safe (FR)" by Hydro Safe Oil Division, Inc.
- D. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.
- E. Machine Beams: Provide framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Division 05 Section "Metal Fabrications" for materials and fabrication.
- F. Car Frame and Platform: Welded steel units.
- G. Guides: Provide roller guides or polymer-coated, nonlubricated sliding guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system for each elevator as required to provide type of operation system indicated.
- B. Single-Car Auxiliary Operations: In addition to primary operation system features, provide the following operational features for elevators where indicated:
 1. Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at main lobby. Manual operation causes automatic operation to cease.
 2. Nuisance Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
- C. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.
 1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers. Provide stripe-swipe card reader integral with each car control station.
 2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car control stations. Key is removable only in deactivated position.
 3. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes car to return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

2.7 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 A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.
 - 1. Textured Stainless-Steel Sheet: Product with embossed texture rolled into exposed surface.
- E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.
- F. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500 or No. C77600.
- G. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS for flat applications.

2.8 CAR ENCLOSURES

- A. General: Provide enameled-steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 - 1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
 - 2. Provide finished car including materials and finishes specified below.
- B. Materials and Finishes: Provide manufacturer's standards, but not less than the following:
 - 1. Subfloor: Underlayment grade, exterior plywood, 5/8-inch nominal thickness.
 - 2. Fabricate car with recesses and cutouts for signal equipment.
 - 3. Fabricate car door frame integrally with front wall of car.
 - 4. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet.
 - 5. Sight Guards: Provide sight guards on car doors.
 - 6. Sills: Extruded nickel silver, with grooved surface, 1/4 inch thick.
 - 7. Handrails: Manufacturer's standard handrails meeting code requirements, of shape, metal, and finish indicated.

2.9 HOISTWAY ENTRANCES

- A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Provide frame size and profile to coordinate with hoistway wall construction.

1. Where gypsum board wall construction is indicated, provide self-supporting frames with reinforced head sections.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Sight Guards: Provide sight guards on doors matching door edges.
3. Sills: Extruded metal, with grooved surface, 1/4 inch thick.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

2.10 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with long-life incandescent lamps and acrylic or other permanent, nonyellowing translucent plastic diffusers or LEDs.
- B. Car Control Stations: Provide manufacturer's standard recessed car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.
- C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 260000 - ELECTRICAL WORK.
- E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car control station. Also provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served.
 1. Include travel direction arrows if not provided in car control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing for each single elevator or group of elevators, but not less than one station for each four elevators in a group.
- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide[one of] the following:
 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
 1. At manufacturer's option, audible signals may be placed on each car.
- I. Corridor Call Station Pictograph Signs: Provide signs matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire

elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Examine hoistways, hoistway openings, pits, and machine rooms as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
 - 1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to minimize transmission of vibrations to structure and thereby minimize structure-borne noise from elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch, up or down, regardless of load and direction of travel.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- H. Locate hall signal equipment for elevators as follows, unless otherwise indicated:
 - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
 - 2. Place hall lanterns either above or beside each hoistway entrance.
 - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, 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 tests are to be performed on elevators.

3.4 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for each 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, cleaning, and adjusting 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.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator.
- B. Check operation of each elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION

SECTION 144200

WHEELCHAIR LIFTS

(Part of Work of Section 140001 - ELEVATORS, Trade Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
 - 1. Vertically-operating wheelchair lifts.
- B. Sustainable Design Intent: Comply with project requirements measured and documented according to the Massachusetts Collaborative for High Performance Schools - (MA-CHPS). Project scores will be verified by a third party certifier.
 - 1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 099000 - PAINTING AND COATING for field painting of lift equipment.
 - 2. Division 26 - ELECTRICAL for electrical service to lifts, including fused disconnect switches.

1.3 SUBMITTALS

- A. Product Data: For each type of lift indicated. Include rated capacities, dimensions, performances, operations, safety features, controls, and finishes.
- B. CHPS Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018113 – Sustainable Design Requirements.
- C. Shop Drawings: For each lift. Include plans, elevations, sections, details, and attachments to other Work. Indicate loading on structure and required clearances.
- D. Certificates and Permits: Provide the Owner with inspection and acceptance certificates and operating permits, as required by authorities having jurisdiction, for normal, unrestricted use of lifts.
- E. Maintenance Data: For each type of lift to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Lift manufacturer or a qualified installer approved by lift manufacturer who has completed lift installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Regulatory Requirements: Comply with ASME A18.1 and Massachusetts Elevator Code.
- C. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG) and the Massachusetts Architectural Access Board.

PART 2 - PRODUCTS

2.1 VERTICAL WHEELCHAIR LIFTS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Garaventa (Canada) Ltd.
 - 2. Savaria (formerly Concord).
 - 3. ThyssenKrupp Access (formerly Access Industries and National Wheel-O-Vator).
- B. Systems and Machinery: Manufacturer's standard preengineered lift systems as indicated in published product literature and as follows:
 - 1. Platform Size: 36 by 48 inches.
 - 2. Rated Speed: 10 fpm.
 - 3. Rated Capacity: 500 pounds.
- C. Power Supply: Suitable for power available in building.
- D. Control System: Provide key-operated control complying with ASME A18.1, 24-V ac.
- E. Manual Lowering: Provide means to manually lower units in case of malfunction or power loss.
- F. Concealed Wiring: Enclose wiring within housings of units. Do not use conduit exposed to view.
- G. Self-Supporting Units: Support vertical loads of units only at base, with lateral support only at landing levels.
- H. Runway Enclosure: Manufacturer's standard rectangular steel-tube frame with flush steel-sheet panels.
- I. Gates: Rectangular steel-tube frames with flush steel-sheet panels.
- J. Platform: 0.125-inch-thick, stainless-steel floor plate.
- K. Platform Sides: Rectangular steel-tube frames with flush steel-sheet panels.
- L. Fixed Ramps: Provide fixed ramps matching platforms to provide transition from floor to lift platform at bottom landings.

- M. Expansion Anchors: Anchor-bolt-and-sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 10 times the load imposed as determined by testing per ASTM E 488 conducted by a qualified independent testing agency:

2.2 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Steel and Iron Finishes: Prepare and finish iron and steel as follows:
 - 1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning," followed by a conversion coating of type suited to organic coating applied over it.
 - 2. Powder-Coated Finish: Immediately after cleaning and pretreating, apply manufacturer's standard, thermosetting polyester or acrylic urethane powder coating with a cured film thickness not less than 1.5 mils.
 - 3. Color and Gloss: As selected by Architect from manufacturer's standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine installation areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
 - 1. Enclose wiring within housings of units or building construction. Do not use conduit exposed to view in finished spaces.
- B. Alignment: Coordinate runway gates with platform travel and positioning, for accurate alignment and minimum clearance between platforms, runway gates, sills, and gate frames.
- C. Position sills accurately, raised slightly above adjoining floor surfaces to minimize intrusion of dirt and spillage into runway. Fill space under sills solidly with nonshrink, nonmetallic grout.
- D. Adjust stops for accurate leveling at each landing, within specified tolerances.
 - 1. Leveling Tolerance: 1/4 inch up or down, regardless of load and direction of travel.
- E. Lubricate operating parts of lift, including drive mechanism, guide rails, gates, safety devices, and hardware.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of lift installation and before permitting use of lifts, perform acceptance tests as required and recommended by ASME A18.1 and governing regulations and agencies.
- B. Operating Test: In addition to above testing, load lifts to rated capacity and operate continuously for 30 minutes between lowest and highest landings served. Readjust stops and other devices and signal equipment for accurate landings and operation of system.
- C. Advise the Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on lifts.

3.4 DEMONSTRATION

- A. Instruct the Owner's personnel in proper use, operation, and daily maintenance of lifts. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train the Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with the Owner on requirements for a complete lift maintenance program.
- B. Make a final check of each lift operation with the Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

END OF SECTION