

PROJECT MANUAL

DOVER HIGH SCHOOL & CAREER TECHNICAL CENTER

Dover, New Hampshire

HMFH Architects, Inc.

130 Bishop Allen Drive

Cambridge, MA 02139

617 492 2200

DESIGN DEVELOPMENT

VOLUME 1 OF 2

March 15, 2016



SET# _____

DOCUMENT 000105
LIST OF CONSULTANTS

Architect:	HMFH Architects, Inc. 130 Bishop Allen Drive Cambridge, MA 02139
Structural Engineer:	Foley Buhl Roberts & Associates, Inc. 2150 Washington Street Newton, MA 02462
Plumbing, Fire Protection, HVAC, Electrical, Technology, and Security:	Garcia Galuska DeSousa Consulting Engineers 370 Faunce Corner Road Dartmouth, MA 02747
Civil Engineer	Nitsch Engineering 186 Lincoln Street, Suite 200 Boston, MA 02111
Landscape Architect:	Crosby Schlessinger Smallridge, Inc. 153 Milk Street Boston, MA 02109
Cost Estimator:	PM & C 59 South Street Hingham, MA 02043
Specifications:	Kalin Associates, Inc. 1121 Washington Street Newton, MA 02465
Geotechnical:	McPhail Associates, Inc. 2269 Massachusetts Avenue Cambridge, MA 02140
Hardware:	Campbell-McCabe, Inc. 85 Central Street, Suite 102 Waltham, MA 02453
Furniture and Equipment:	Tavares Design Associates Inc. 319 Massachusetts Ave Arlington, MA 02474

Hazardous Materials:

Universal Environmental Consultants
12 Brewster Road
Framingham, MA 01702

Acoustics, Theater and Sound System:

Cavanaugh Tocci Associates, Inc.
327 F Boston Post Road
Sudbury, MA 01776

END OF DOCUMENT

DOCUMENT 000107
PROFESSIONAL SEALS

SPECIFICATIONS FOR
Dover High School & Career Technical Center

Designer
Architects

Structural Engineers

Landscape Architects

Civil Engineers

Fire Protection Engineers

HMFH PROJECT NO. 403114
March 15, 2016

Dover High School & Career Technical Center
Dover, NH

HVAC Engineers

Plumbing Engineers

Electrical Engineers

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SECTION 011100
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. Available project information.

1.3 WORK UNDER THIS CONTRACT

- A. Project Identification:
Dover High School & Career Technical Center
- B. Project Location:
Dover, NH
- C. Owner:
Dover School Board
- D. Architect:
HMFH Architects, Inc.
130 Bishop Allen Drive

Cambridge, MA 02139
Contact Person: Bobby Williams

E. Description of the Work

1. Project consists of constructing a new 3-story high school building and ancillary buildings; abatement/demolition of the existing school building, and associated site work in Dover, NH. Refer to drawings and specifications for additional requirements.

1.4 CONTRACT METHOD:

- A. Project will be constructed under a single prime contract. This Contract shall be a General Contract for Construction, bid as required by 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. 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.
- C. 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 and Phasing:
 - a. Sitework phasing.
 - b. Abatement and demolition.
 - c. New Construction.
 - d. Sitework completion.

- B. Owner Responsibility: Prior to commencement of construction at the site, the Owner will **remove furnishings from existing buildings**.
- C. Critical Submittals: No structural steel submittals will be reviewed by the Designer until product data and shop drawings for the following equipment has been submitted and approved:
 - 1. Rooftop HVAC units.
 - 2. Fan coil units.
 - 3. Cooling tower.
 - 4. Generator.

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.

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 – 5PM Weekdays // 7AM – 4PM Saturdays // No Work Sundays & 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.
- 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 Designer and such Authority timely notice of its readiness so the Designer 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.] [The General Contractor shall pay for Building Permit and other permits required by local authorities unless otherwise indicated.]**

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 sit 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 Designer 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 Designer", "requested by Designer", "authorized by Designer", and other like items. No implied meaning shall be

- interpreted to extend the Designer's responsibility into the Contractor's area of construction supervision.
3. Approve: The term "approved" when used in conjunction with the Designer's action on the Contractor's submittals, applications, and similar requests, is limited to the duties and responsibilities of the Designer 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 Designer.
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 Designer 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.
- C. Product and Material Requirements: In addition to product and material requirements as specified throughout the Project Manual, preference shall be given to materials mined or manufactured in New Hampshire first and the United States of America second wherever possible.

HMFH PROJECT NO. 403114
March 15, 2016

Dover High School & Career Technical Center
Dover, NH

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. Section 310000 – 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. Refer to the attached Safety and Traffic Control Plan, which is hereby made part of the Contract Documents.
- 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.
 - c. Monthly cost projections.

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. HMFH Architects, Inc. 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 HMFH Architects, Inc., or any other Person or Firm involved in the

creation, production 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 HMFH Architect, Inc., 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, HMFH Architects, Inc. 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, HMFH Architects, Inc. 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.

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. Contractor shall be responsible for notification to neighboring properties as required.

3.3 CONDUCT OF CONSTRUCTION PERSONNEL

- A. Smoking is not permitted on school property, including the construction site.
- B. Under no circumstances shall workers on site have interactions with students.
- C. Use of profanity is prohibited.

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.

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, 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 like items

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 Contractor 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: [Contractor]
[Street]
[Town, State]

Date: [Date documents are transmitted]

Project: Dover High School & Career Technical Center

RE: Project Electronic Files

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

The undersigned agrees to accept from HMFH Architects, Inc. and its consultants 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 HMFH Architects, Inc. and its consultants for each instance.

The undersigned further agrees to release, indemnify, hold harmless and defend HMFH Architects, Inc. and its consultants 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,
HMFH Architects, Inc.

Accepted and Agreed to:

(General Contractor)

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 - Volumes 1 & 2	Entire Bid Set of Drawings
PDF	Specifications - Volumes 1 & 2	Entire Project Manual
PDF	Addenda	All Addenda Issued
DWG	Entire X Series	Existing Conditions Plan (Site Survey)
DWG	Entire Series	Civil Drawing Plans
DWG	Entire L0, L1, L2 & L3 Series	Landscape Drawing Plans
DWG	Entire A2, A3, A4 & A5 Series	Architectural Plans, Elevations, Wall Sections
DWG	Drawings EQ-1 through EQ-8	Equipment Floor Plans
DWG	Drawings FS-1 and FS-2	Food Service Equipment Plans
DWG	Entire S2, S3, S4, S5, S6 Series	Structural Plans and Details
DWG	Entire FP Series	Fire Protection Plans and Riser Diagram
DWG	Entire P Series	Plumbing Plans and Diagrams
DWG	Entire M Series	Mechanical Plans, Schedules and Diagrams
DWG	Entire E Series	Electrical Plans, Schedules and Diagrams
DWG	Entire SEC Series	Security Plans and Diagrams
DWG	Entire T1, T3 and T4 Series	Technology Plans, Schedules and Diagrams
DWG	Entire AE and AS Series	Audio Visual Systems Plans and Diagrams
DWG	Entire TL and TR Series	Theatrical System Plans and Diagrams

Additional Electronic Files for Use during Construction:

File designation	Document number	Document title
013301.PDF	Document 013301	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 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 DESCRIPTION OF WORK

- A. This Section includes administrative and procedural requirements for unit prices and estimated quantities.
- B. Related Sections include the following:
 - 1. 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 BID FORM – GENERAL BIDDER CONTRACT.

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 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. Re-

- quests 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 Document 004100 – BID FORM – GENERAL BIDDER CONTRACT contain requirements for materials described under each unit price.
 2. A Schedule of unit prices and estimated quantities to be proposed by Bidders immediately follows this section and shall be included with the bid form.
- E. Refer to INSTRUCTIONS TO BIDDERS, and BID FORM – GENERAL BIDDER CONTRACT, for additional information regarding unit prices and estimated quantities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

APPENDIX 012201
UNIT PRICE PROPOSAL SHEET
DOVER HIGH SCHOOL & CAREER TECHNICAL CENTER
DOVER, NH

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

12	Division 33 – Utilities: Vertical rebuild of existing sewer/drainage structure	Linear foot	
13	General Contractor Shall provide moisture mitigation below resilient flooring. Refer to Section 096500 - Resilient Flooring for flooring finish. Refer to Section 090160 - Vapor Mitigation at Slabs for moisture mitigation requirements. Approximate Square Feet: 37,570.	Square Feet	
14	General Contractor Shall provide moisture mitigation below resilient athletic flooring. Refer to Section 096566 - Resilient Athletic Flooring for flooring finish. Refer to Section 090160 - Vapor Mitigation at Slabs for moisture mitigation requirements. Approximate Square Feet: 3,200.	Square Feet	
15	General Contractor Shall provide moisture mitigation below fluid-applied flooring. Refer to Section 096700 - Fluid-Applied Flooring for flooring finish. Refer to Section 090160 - Vapor Mitigation at Slabs for moisture mitigation requirements. Approximate Square Feet: 2,005.	Square Feet	
16	General Contractor Shall provide moisture mitigation below carpeting and entrance mats. Refer to Sections – 096820 - Carpeting and 124810 - Entrance Floor Mats and Frames for flooring finish. Refer to Section 090160 - Vapor Mitigation at Slabs for moisture mitigation requirements. Approximate Square Feet: 3,245.	Square Feet	

17	Division 32 – Exterior Improvements: Planting Bed Soil Mix.	Cubic Yard	
18	Division 32 – Exterior Improvements: Tree 5-6" cal.	Each	
19	Division 32 – Exterior Improvements: Shrub 3-4' ht	Each	
20	Division 32 – Exterior Improvements: Herbaceous Plant #1 pot	Each	

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 Instructions to Bidders.

***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 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. 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 amount for all work to be performed by the General Contractor and subcontractors.

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. Alternate #1: Provide removable seating in the Orchestra Pit. Refer to drawings and specifications for requirements.
- B. Alternate #2: Provide two additional tennis courts. Refer to drawings and specifications for requirements.
- C. Alternate #3: Provide irrigation for soccer and softball practice fields. Refer to drawings and specifications for requirements.
- D. Alternate #4: Provide track repairs. Refer to drawings and specifications for requirements.
- E. Alternate #5: Provide 2.5 mm thick linoleum tile flooring in lieu of 2.0 mm thick linoleum tile flooring. Refer to drawings and specifications for requirements.

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.
 - 3. Provide Schedule of Values in AIA-G702 and G703 format.

- 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.

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 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.
 15. Final cleaning.
 16. Punchlist preparation and response.
 17. Maintenance of as-built documents for architectural and site work; preparation of close-out documents.
 18. Commissioning coordination activities.
 19. Overhead.
 20. 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]

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:
1. 1 Full-time Superintendent: Superintendent shall be licensed in the State the project is located in, 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 and document construction waste removal.
 3. 1 Project Manager: The Contractor shall also provide an adequate project manager for the management, proper coordination, and expediting of the 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 State the project is located in, 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, and other like items
- 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, ac-

ceptable to Architect and the Owner.

1. Registered professional engineer of the discipline required for the specific service on the Project, licensed in the State the project is located in.

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. Building Envelope Coordination Meeting: The GC shall coordinate a pre-construction meeting on site with all of the building envelope Subcontractors, the OPM, Clerk, and Architect.
- C. GC shall coordinate and produce color coded coordination drawings of each system showing interface between each building envelope system.
- D. 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
- E. Coordination drawings must be completed prior to system application on the mock-up(s).

- F. Coordination Drawings shall be reviewed and signed off by each building envelope trade.
- G. 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 meeting. 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 Contractor 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 Designer 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.
 - 4. The Contractor shall take minutes of such meetings & shall distribute copies of the minutes to all concerned.
- 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.
 - 5. Daylight dimming system.
- 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 schedule 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.
- D. The Contractor shall take minutes of such meetings & shall distribute copies of the minutes to all concerned.

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. Phasing requirements.
 - 4. Requirements for scheduling closeout activities.
 - 5. Critical Path Method Schedule preparation and submission.
 - 6. 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. 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.
- F. Photographs:
1. Photographic documentation of construction as specified herein.
 2. Copies of prints:
 - a. Submit electronic 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 each print file, provide the following information:
 - a. Name of Project.
 - b. Date photograph was taken if not date stamped by camera.
 - c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - d. 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 and AIA-A101, for provisions for, and amounts of, Liquidated Damages.

1.5 PHASING

- A. The project shall be phased in accordance with the phasing plans as described on the architectural drawings and in the INSTRUCTIONS TO BIDDERS.

1.6 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. Flush-out shall be complete prior to substantial completion.
- 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.

1.7 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. Flush-out shall be complete prior to substantial completion.
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 subcontractor.

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. (lifts may be a little too much)
- 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 within remaining contract durations. The Recovery Schedule shall conform to requirements set forth in Paragraph 1.04 (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 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 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. 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.
- C. 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.
- D. 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.
- E. 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.
- F. 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) calendar 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 Ar-

chitect 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. Informational submittals
 - 8. Action on submittals.
 - 9. 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: 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 45 days after signing the Agreement, to be submitted with the CPM Schedule, 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 in paragraph 2.01 A. 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 that the CPM shows requirement 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 Architect shall be ordered or installed until such approval has been obtained.
- B. Product List for Color Selection: To facilitate the preparation of the color schedule, the Contractor shall, along with the CPM, 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: Face brick; exterior concrete masonry units; factory-finished metal siding; 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; lockers; 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.
 1. Submittal packages shall contain all required information in accordance with the submittal requirements of each specification section. Incomplete submittals will be returned without review.
- 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 additional 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 web-based file transfer service specified herein.
4. GC is responsible for distribution to all trades.
5. GC to deliver 1 hard copy of "Reviewed" and "Approved and Furnish as Corrected" submittals to Clerk.
6. Drawings submitted directly from Subcontractors, manufacturers or vendors, or directly to the Architect's consultants, will be returned to the Contractor without action.

D. Web-Based Construction Administration Database:

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. Newforma.
 - d. Or equal.
2. The Contractor shall provide licensed seats/access to, and training on said database, for all of the Architect's Consultant's and OPM's CA Team Members, to facilitate electronic transmittal of all of Construction Documentation including, but not limited to Project submittals, RFI's and Change Order Requests, Architect Directives, Sketches, Meeting Minutes, and Architect Field Reports.
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, 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. 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. Each drawing shall have a clear space approximately 80 square inches as an additional border on the right or bottom for stamps and Architect's comments.
- D. 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.
- E. 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.
- 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 forth 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, Sub-contractors, 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.
- 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, and 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.
- B. Informational submittals required for the Work include, but are not limited to, the following:
 - 1. Storm Water Pollution Prevention Plan Documentation, as specified in Section 011400 – WORK RESTRICTIONS
 - 2. Calculations for Contractor-engineered work, as specified in particular specification sections in Divisions 2 through 50.
 - 3. Research/evaluation reports and test data as specified in particular specification sections in Divisions 2 through 50.
 - 4. Certifications and other qualification data, as specified in particular specification sections in Divisions 2 through 50.
 - 5. Maintenance data, as specified in particular specification sections in Divisions 2 through 50.
 - 6. Confirmation of contract with printing company as specified in this Section.

2.8 SUBMITTAL REQUIREMENTS FOR COMMISSIONING

- A. Submittals:
 - 1. Submit digital copy of applicable submittals for equipment to be commissioned to Commissioning Authority (CxA).
 - 2. CxA will review and approve 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.
- 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 Architect 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 con-

- ervation, 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: DOVER HIGH SCHOOL & CAREER TECHNICAL CENTER

To: HMFH Architects, Inc.
130 Bishop Allen Drive
Cambridge, MA 02139

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)? 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 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



Submittal Review Transmittal

Submittal No.:

(GC Insert Submittal
number)

Project:	Hanover High School	Contract For:	New Construction
Prepared By:	(GC Insert General Contractor's Project Manager & Company Name)	To:	HMFH Architect, Inc. 130 Bishop Allen Drive Cambridge, MA 02139
Subcontractor :	(GC Insert Subcontractor's contact & Company Name)	Contractor's Reference Date from Submittal Schedule:	(GC Insert date)
Specification Reference:	(GC Insert Section & paragraph number)	Date Due back to Contractor from Submittal Schedule:	(GC Insert date)
Submittal Type:	(GC Select -Product Data, Certification, Test Report, Shop Drawing or Sample)	Date Received by HMFH:	(To be filled in by Archtiect)
Submittal Title:	(GC-Insert Submittal Name)	Date Returned to Contractor:	(To be filled in by Archtiect)

General Contractor's Review Comments

(GC Provide GC's stamp and any applicable comments or notations in this box)

Architect's Review Comments

(Architect will provide stamp and comments in this box)

SECTION 01 35 43
ENVIRONMENTAL 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 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 RELATED WORK UNDER OTHER SECTIONS

- A. Asbestos Remediation.

1.3 HAZARDOUS MATERIALS PROCEDURE

- A. Asbestos:
 - 1. Asbestos Materials Exist On-Site: There are accessible and inaccessible asbestos containing materials (ACM) in the existing building. ACM affected by the demolition project are included under this contract. The Demolition Contractor shall refer to items 6, 7, 8 and 9 below for proper procedures regarding removal and disposal of damproofing, flashing and transite pipes. The Demolition Contractor shall formally notify each subcontractor that there are ACM existing in the building. Hidden ACM may only be found during demolition and renovation. Refer to items 2 and 3 below.
 - 2. Unknown and inaccessible ACM: During demolition, it is possible that previously unknown asbestos materials may be discovered in currently concealed locations.
 - 3. Notification: If the Demolition Contractor or other trades discover or encounter any ACM during the performance of the work, the Demolition Contractor or other trades shall immediately:
 - a. Stop work, notify the C.M at Risk Contractor and Clerk of the Works about the presence of suspect ACM and request instructions for proper action, and
 - b. Take whatever steps and measures are necessary to reduce, control or eliminate the risk of exposure of workers and the public to the ACM.
 - c. Every effort will be made to obtain the 10-day DEP waivers to remove hidden or unforeseen ACM by the asbestos contractor. The Demolition Contractor or other trades shall allow sufficient time for the removal of the ACM at no additional charges to the owner for delays and should waivers are denied.
 - 4. Responsible Person On-Site: The C.M at Risk Contractor shall designate one of its senior on-site employees to be in charge of coordination between the HAZ MAT Consultant, Architect, the Demolition Contractor, and all subcontractors with respect to hazardous materials issues.
 - 5. Responsibility for Hazardous Material Discovery: It is the sole responsibility of the Demolition Contractor, C.M at Risk Contractor and Sub-Contractors to undertake whatever measures, methods or procedures are necessary, required or otherwise appropriate to safeguard the health and safety of all workers and members of the public with respect to identification and discovery of previously unknown hazardous materials during the work of the Project.

6. Foundation and building flashing (including under window systems, door systems and walls) were assumed to exist throughout the building and assumed to contain asbestos. It is the Demolition Contractor's responsibility to properly expose, remove and dispose at no additional cost to the Owner in accordance with all federal and state regulations. The Demolition Contractor is solely responsible for means and methods and techniques used to properly remove and dispose of the ACM and shall comply with all federal, state and OSHA regulations. The Demolition Contractor shall include in his bid the disposal of 10 ton of the ACM. UEC on-site project monitor will record on a daily basis all quantities removed. The Demolition Contractor will be required to do the same. At the completion of the Demolition project, should quantities of ACM removed were found to be less than 10 ton, the Demolition Contractor will be required to issue a credit to the owner based on \$125.00 per ton or will be paid \$135.00 per ton should quantities of ACM coated walls removed were found to be greater than the listed above. The unit price includes all applicable costs. It is also the Demolition Contractor's responsibility to comply with DES.
7. Dampproofing, including but not limited to paper, glue, glue daubs on Styrofoam (Coated Walls) and structural columns and beams were assumed to contain asbestos and assumed to exist throughout the building including foundation walls below grade. The ACM was assumed to be sandwiched between the outside walls. The Demolition Contractor shall excavate around the foundation walls and shall separate/segregate ACM coated walls/columns and beams from non-ACM walls and to perform the removal work at no additional cost to the Owner in accordance with all federal and state regulations. The Demolition Contractor is solely responsible for means and methods and techniques used to properly remove and dispose of the ACM and shall comply with all federal, state and OSHA regulations. The Demolition Contractor shall include in his bid the disposal of 2,500 ton of ACM coated walls/columns and beams. UEC on-site project monitor will record on a daily basis all quantities removed. The Demolition Contractor will be required to do the same. At the completion of the Demolition project, should quantities of ACM coated walls/columns and beams removed were found to be less than 2,500 ton, the Demolition Contractor will be required to issue a credit to the owner based on \$125.00 per ton or will be paid \$140.00 per ton should quantities of ACM coated walls/columns and beams removed were found to be greater than the listed above. The unit price includes all applicable costs including but not limited to site preparation, demolition, segregation, transportation and disposal. It is also the Demolition Contractor's responsibility to comply with DES. Certain interior walls (previously exterior due to additions) might be coated with ACM and shall be properly removed and disposed. Refer to item 9 below.
8. Quantities for materials included above in items 6 and 7 are in an addition to the scope required to demolish/dispose of the building per the demolition sections and only to be used for additions and deduction. Credit shall be given to the owner for all quantities listed above multiplying by the credit prices should less ACM was found. The Demolition Contractor shall carry all costs related to demolition and disposal in his bid as non-ACM and all scope and quantities listed above in items 6 and 7. The Demolition Contractor shall own the cost for any loss of salvage values of the columns and beams at no additional cost to the owner should ACM was found.
9. Transite and ACM insulated pipes were assumed to exist underground. The Site or Demolition Contractor shall excavate around the pipes to expose the pipes at no additional cost to the owner for removal by the asbestos contractor.
10. Indemnification: To the fullest extent permitted by law, the Demolition Contractor, C.M at Risk Contractor and Sub-Contractors shall indemnify and hold harmless the Owner and the Architect and their agents and employees from and against all claims, damages, losses and expenses including, but not limited to, attorneys' fees arising out of or relating to the performance of the Work, including the discovery or identification of any hazardous materials, provided that any such claim, damage, loss or expense if attributable to bodily injury, sickness, disease or death, or to damage to or destruction of tangible property (other than the Work itself) including the loose of use resulting therefrom; and is caused in whole or in part by any negligent act or omission of the Demolition Contractor, C.M at Risk Contractor and Sub-Contractors, anyone directly or indirectly employed by any of

them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

B. Lead:

1. The Demolition Contractor, C.M at Risk Contractor and Sub-Contractors shall be made aware that Lead Based Paint exists on painted surfaces throughout the building including structural columns and beams.
2. All the work of this Contract shall conform to the standard set by all applicable Federal, State and Local laws, regulations, ordinance and guidelines in such from in which they exist at the time of the work on the Contract and as may be required by subsequent regulations.
3. The Demolition Contractor, C.M at Risk Contractor and Sub-Contractors are solely responsible for means and methods, and techniques used for demolition and lead control. The Demolition Contractor shall collect and control lead contaminated debris and to properly remove and dispose of lead contaminated soil around each building due to demolition activities.
4. The Demolition Contractor shall at his own cost and expense comply with all laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during demolition, prepping, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing and disposing of lead and lead contaminated waste material.
5. The Demolition Contractor shall submit to the Architect prior to commencing of work the following:
 - a. Written respiratory and notification program
 - b. Written lead compliance program in accordance with OSHA regulations including:
 1. Training requirement certifications.
 2. Supervisor qualifications.
 3. Written compliance program specific to this project
 4. Respirators fit test records.
 5. Medical surveillance certificates.
6. The EPA requires demolition debris with lead to be tested in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) to determine the potential for significant amounts of lead to leach out of the waste. If the results are below the 5.0 ppm, the waste may be disposed of in a conventional landfill for demolition debris. If, however, the TCLP results are above the limit, the waste must be disposed of in a DES approved, hazardous waste landfill. The Demolition Contractor shall at own cost and expense perform all required testing of waste by the TCLP. The Demolition Contractor must submit to the Owner copy of tests performed and all waste shipment records prior to disposing of debris. The Owner reserves the right to have own TCLP samples collected to verify results. All disposal costs shall be at the Demolition Contractor's responsibility.
8. The following references are cited as current applicable publications. This project is subject to compliance with the all regulations including but not limited to:
 - c. U. S. Department of Labor, Occupational Safety and Health Administration Title 29 CFR 1910.1025 and 29 CFR Part 1926.62.
 - d. U. S Department of Environmental Protection, Resources Conservation and Recovery Act.
 - e. State of New Hampshire regulations and standards.
9. All above regulations are applicable to this project. Where there is a conflict between this section and the applicable regulations, the more stringent requirement shall prevail.

C. Other Hazardous Materials:

1. The Demolition Contractor shall be made aware that other hazardous materials are found inside/outside the building. The Demolition Contractor shall be responsible for quantifying, removal and proper disposal of all hazardous materials in/out the building, including but

not limited to batteries and related electrolytic material, PCB's, mercury and Freon inside air conditioners, switches, exit signs, thermostats and other items.

D. PCB's:

1. The Demolition Contractor, C.M at Risk Contractor, Sub-Contractors and Asbestos Contractor shall be made aware that building materials (Material) including but not limited to painted surfaces, glue, roofing, coatings and other building materials are likely to contain >1 ppm of Polychlorinated Biphenyls PCB's. Caulking was found to contain >1ppm but <50 ppm of PCB's.
2. Due to the difficulty associated with exhaustive testing of all surfaces, glue, and coatings within the building, the Owner has elected to direct the Demolition Contractor, C.M at Risk Contractor, Sub-Contractors and Asbestos Contractor to assume that these surfaces do, in fact, contain PCB's and to take all necessary steps for their compliant removal and disposal.
3. All of the work of this Contract shall conform to the standard set by all applicable Federal, State and Local laws, regulations, ordinance and guidelines.
4. The Demolition Contractor, C.M at Risk Contractor, Sub-Contractors and Asbestos Contractor are solely responsible for means and methods, and techniques used for demolition and control. The Demolition Contractor, C.M at Risk Contractor, Sub-Contractors and Asbestos Contractor shall collect and control PCB's contaminated debris and soil.
5. The Demolition Contractor, C.M at Risk Contractor, Sub-Contractors and Asbestos Contractor shall at its own cost and expense comply with all laws, ordinance, rules and regulations of Federal, State, Regional and Local authorities during prepping, sanding, cutting, burning, scraping, painting over, grinding and regarding handling, storing and disposing of contaminated waste material and during demolition of the building.

PART 2 – (PRODUCTS) Not Used

PART 3 – (EXCUTION) Not Used

END OF SECTION

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.

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 minimum 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 Pro-

ject 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, according to ASTM E 329; 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 materials 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 Specification 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.

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 prosecution 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.
 1. Provide for relocating the construction trailer in accordance with phasing schedule.
- 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 New Hampshire 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 Contractor 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 like items, 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 not be used for temporary heating.
- 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 Control, 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 6, 9, 10, 11 and 12 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 like 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 ordi-

nances 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. In addition, provide the following:
 - 1. Replace lamps that burn-out.
 - 2. Replace lamps that get damaged.
 - 3. Limit hours of use of the lights as acceptable to Architect.
 - 4. Clean light fixtures during final cleaning. Lighting protective plastic wrap shall remain on light fixtures to the extent possible, until final cleaning.
- 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 AND HIGH SPEED INTERNET

- A. Arrange with local telephone company to provide direct line telephone service at each 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/OPM equipped with electronic answering machine; plus one direct line for facsimile machine in office. Turn over keys to Clerk of the Works, OPM and Architect.
 - 3. High Speed internet access, 6.0 Mbps minimum downstream speed, modem to accept the appropriate service provided, and wireless router via DSL, Broadband, Cable, or equal with unlimited internet access to the Field offices of the Contractor and Clerk of the Works/OPM.
 - 4. Other instruments at the option of the Contractor, or as required by regulations.
 - 5. 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 Final 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.

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. Temporary ladders, ramps, runways, stairs, and similar items required for proper execution of Contractor's work and that of the Subcontractors shall be properly maintained. Use of such facilities by other contractors, subcontractors and trades shall be permitted as required by construction schedule.

1.14 TEMPORARY HOISTS AND CHUTES

- A. Each trade shall provide its own hoists, 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 chutes, derricks, 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 CONTROL, for requirements for temporary interior partitions to enclose portions of the work where required for protection of indoor air quality.
 - 1. Provide sound attenuation batts and insulated, weather stripped doors in temp partitions to reduce sound transmission between occupied and unoccupied areas.
- 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, at each site as shown on Drawings. Fence shall be installed in a manner that will not impact wetlands.
- 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.
- 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. 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 each site.
- D. No other signs or advertisements will be allowed on building or premises.
- E. Erect where required for DEP File No. in accordance with Wetland Regulations and the Order of Conditions where applicable.

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. Heat during cold weather below 55 degrees F.
 - 2. One layout table, approximately 36" x 84" with one drafting stool and two drafting lamps with bulbs.
 - 3. Two desks (30x60 standard double pedestal steel desks with plastic laminate tops, two-drawer letter hanging file on one side, three drawer pedestal on the other side, center pencil drawer. Drawers shall lock; furnish two keys per desk.) and desk chairs (swivel type upholstered chair with arms, fully adjustable seat heights and variable back rests; five caster bases with wheels) in separate offices. One desk and one desk chair in the main area. Include one spring-mounted desk light per desk.
 - 4. Four conference tables, each 72 by 30 inches, with plastic laminate top.
 - 5. Sixteen straight back folding chairs with cushioned seats.
 - 6. Six Fireproof metal file cabinets (4 drawers each) with locks, hanging frame inserts, hanging file holders and folders (50 per drawer). Drawers shall lock; furnish each cabinet with three keys.
 - 7. One hat shelf with room for 20 hard hats.
 - 8. One sloped surface plan review table, 42 by 72 inches, with raised lip at low edge.
 - 9. Six portable plan rack units on casters; 12 stick capacity each. Include twelve 3 knob sticks per unit.
 - 10. Two desk-type telephones with speakerphone feature.
 - 11. One electronic telephone answering machine.

12. One coat rack, consisting of wall mounted panel equipped with eight coat hooks, six 20 gallon wastepaper baskets, three 30"x40" wall-mounted tackboards and three 36 by 48 inch whiteboards with tray. Furnish each whiteboard with four colored markers and one eraser.
 13. One exterior high quality mercury thermometer.
 14. Air conditioning during weather above 75 degrees F.
 15. 12-inch deep steel shelving, forty linear feet.
 16. Sufficient number of electric lights (50 fc at desk level over entire area) and outlets.
 17. One Dell MFP3115cn 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. Include cable connections to USB port and service program with 3 years parts and labor warranty with 3 years onsite service with response time within 24 hours of notice. Provide technician to setup printer and printer capabilities (print, scan, fax, and other like items) on up to four owner/ rep/ clerk computers.
 18. One facsimile transmitting and receiving machine with dedicated telephone line.
 19. Supplies: Office supplies, including toners for all equipment, ten hard hats, four safety glasses, four safety vests and raincoats.
 20. One water-cooler: Provide dispenser which holds bottled water and furnishes instant hot as well as cold water, supply with flat bottom paper cups, and weekly bottle replacement for the duration of the project.
 21. One refrigerator, two door, 3.3 cu ft capacity.
 22. One microwave, 0.9 cu ft capacity counter top model.
 23. One industrial quality wall-mounted first aid kit sized and supplied for 10 people.
 24. One automatic coffee machine equal to 2011-02 Keurig B140 Brewing System including coffee for the duration of the project.
 25. One UPS backup power unit, 20 minute capacity, auto shutdown on power failure.
 26. Power strip with surge protector, and dust covers for all equipment; provide three..
 27. Electronic labeling system: desktop model, Brother # PT2700 or equal. Furnish with tape and other supplies for duration of project.
- 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 weekly cleaning service in each office, with monthly waxing. Contractor shall maintain pathways to trailers from construction site and parking area free of water, snow and ice.
- F. Provide routine emergency service for office equipment specified and reasonable quantities of expendable supplies as required for job related use. Consumables include:
1. Fax machine, copiers, printer: toner and paper.
 2. Drinking Water: Provide bottled spring water for water dispenser in 6 gallon bottles, delivered as necessary to avoid running out, coffee for machine, and continuous stock of flat bottom cups.
 3. Lamps: bulbs and fluorescent lamps of appropriate types and wattage for the trailer fixtures.

HMFH PROJECT NO. 403114
March 15, 2016

Dover High School & Career Technical Center
Dover, NH

PART 3 - EXECUTION (NOT USED)]

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT MATERIAL 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.
- 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, the following:
 - 1. Installation of temporary tree protection fencing at existing trees and shrubs to remain.
 - 2. Protection of existing improvements to remain.
 - 3. Post construction clean-up.

1.3 RELATED WORK

- A. Related work includes, but is not limited to, the following work covered in other sections:
 - 1. SECTION 02 41 19 – SELECTIVE DEMOLITION
 - 2. SECTION 31 00 00 – EARTHWORK
 - 3. SECTION 31 13 00 - SELECTIVE TREE AND PLANT MATERIAL REMOVAL

1.4 REFERENCES

- A. Comply with applicable requirements of:
 - 1. State of New Hampshire, Standard Specification for Roads and Bridge Construction, Department of Transportation, latest edition.
 - 2. City of Dover, of the State of New Hampshire, and of other authorities having jurisdiction. Provide labor, materials, equipment and services to comply with requirements.
 - 3. ASTM: American Society for Testing and Materials.
 - 4. AASHTO: American Association of State Highway and Transportation Officials.
 - 5. AAN: American Association of Nurserymen.
 - 6. ISA: International Society of Arboriculture.
 - 7. ANSI: American National Standards Institute.

1.5 SUBMITTALS

- A. Prepare and submit in accordance with SECTION 01 33 00 – SUBMITTAL PROCEDURES.

1.6 QUALITY ASSURANCE

- A. Temporary tree and plant material protection shall be performed by a certified landscape contractor with a minimum of five years of related work experience and under full time supervision of a qualified supervisor.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store all products in unopened original manufacturer's packaging. Store all materials in strict accordance with manufacturer's instructions and recommendations. Protect materials from all damage. Conform to provisions of SECTION 01 60 00, PRODUCT REQUIREMENTS.

1.8 WARRANTY

- A. In addition to the guarantee/warranty requirements of the Contract and General Requirements, the Contractor shall obtain in the name of the Owner the standard manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. These guarantees are in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

1.9 PROJECT CONDITIONS

- A. General: The Contractor shall visit and accept the site as he/ she finds it, and shall inform him/herself of the character and the type of plant material items to be protected. The Contractor shall walk the site with the Landscape Architect prior to commencing work to determine the full scope of plant materials to be removed and plant materials to remain.
- B. Damage or loss to site improvements shall be at the risk of the Contractor from and after the date of Contract execution, and no such damage or loss shall relieve the Contractor from any obligation under the Contract.
- C. Traffic: Adjacent building areas, site areas and streets will continue to be used throughout the construction process. Contractor shall use extreme care to protect the safety and welfare of pedestrians and occupants of these areas. Submit pedestrian access plan prior to beginning work.
- D. Conduct operations and removal of debris to ensure minimum interference with the normal use of streets, public ways, and other adjacent facilities. Do not close or obstruct adjacent buildings, loading docks, traffic ways, corridors, streets, walks or other used facilities without the written permission of the Owner and authorities having jurisdiction.
- E. Protection: Existing buildings and traffic ways adjacent to the work site will be occupied during construction operations. Ensure the safe passage of vehicles and persons in and around the work areas during and after demolition. Prevent injury to persons and damage to property. Immediately repair damaged property to its condition before being damaged.
- F. Protection of Existing Landscaping to Remain: Prior to beginning any work of the Contract on site, take effective action to protect all existing landscaping indicated to remain. Refer to requirements specified herein.

- G. Dust and Noise Control: Take effective measures to prevent windblown dust and to control noise to avoid creating a nuisance. Obtain Landscape Architect and Owner's approval of means, methods and techniques used to control dust and noise. Chemicals deleterious to plant growth may not be used on sub-grades of areas that will be sodded, seeded, or planted. Avoid creating ice hazards in freezing weather.
- H. Utilities: Maintain all utilities except those requiring removal or relocation. Keep utilities in service and protect from damage. Do not interrupt utilities serving used areas without first obtaining permission from the utility company and the Owner. Provide temporary services as required and review interim utility service plan with the Owner and Architect prior to interruption of service.

1.10 LOCATION OF UTILITIES

- A. The Contractor must verify the location of all utilities in the limit of work before starting work, including but not limited to gas, electric, telephone, storm drainage, sanitary drainage, fiber optic, telecommunication, cable, and water services.

1.11 EXAMINATION OF SITE AND DOCUMENTS

- A. The Contractor shall carefully study the Contract Documents and shall fully inform him/herself of existing conditions of the site before submitting his/ her bid and before starting work. The Contractor shall at once report to the Landscape Architect any errors, inconsistencies or omissions he/ she may discover. The Contractor shall be fully liable to the Owner for any damage resulting from such errors, inconsistencies or omissions in the Contract Documents.
- B. The Contractor shall be fully responsible for carrying out all site work required to fully and properly execute the work of the Contract, regardless of the conditions encountered in actual work. Plans, surveys, measurements and dimensions under which the work is performed are believed to be correct to the best of the Owner's knowledge, but the Contractor shall have examined them for him/herself during the bidding period, as no allowance will be made for any errors or inaccuracies that may be found therein.
- C. On all Project Drawings, figures take precedence over measurements by scale. The Landscape Architect shall decide on questions that may arise regarding the meaning and intent of the Project Drawings and Project Specifications. If any Project Drawings or figures that are necessary for a clear understanding of the Work are omitted, or if any error appears in either Project Drawings or Specifications, or if discrepancies are found between the Project Drawings and Project Specifications, it shall be the duty of the Contractor to notify the Landscape Architect of such omissions, errors or discrepancies, and in no case proceed in uncertainty. If any mistakes arise in consequence of such neglect on the part of the Contractor to notify the Architect, the Contractor must correct the work at his/ her own expense.
- D. The Contractor shall perform no portion of the Work at any time without the Contract Documents or, where required, Product Data, Samples, or other Submittals for such portion of the Work. No claim for extra compensation or extension of time will be allowed on account of actual conditions inconsistent with those assumed, except those conditions described in SECTION 00 72 00 – GENERAL CONDITIONS.

1.12 EXISTING UTILITIES

- A. The Contractor shall locate and mark underground utilities to remain in service before beginning work. Markings shall remain throughout the length of the project.
- B. Protect all existing utilities to remain during operations. In work on or around the utilities, follow all rules and regulations of the respective utility. Do not interrupt existing utilities except as

authorized by authorities having jurisdiction. Provide not less than 72 hours written notice to Owner if shut down of utility service is required.

- C. Active utilities shall be adequately protected from damage and removed only as indicated on Drawings or as directed by the Landscape Architect. Where active utilities are encountered but not shown on the Drawings, the Contractor shall notify the Landscape Architect immediately in writing. The Contractor shall protect and maintain these utilities until written instructions are received from the Landscape Architect.
- D. Inactive and abandoned utilities and drains encountered in tree and plant material protection operations shall be reported to the Landscape Architect immediately.

1.13 PROTECTION

- A. All local rules and regulations governing the works shall be observed by the Contractor in executing all work under this section.
- B. All work shall be executed in a manner to prevent any damage to existing buildings, streets, pavings, vegetation designated to remain, service utility lines, structures, existing improvements, adjoining property and existing improvements on adjoining property. Protect from damage all utilities that are to remain.
- C. Items to remain and existing improvements that are damaged shall be restored to their original condition that is acceptable to the Landscape Architect and parties having jurisdiction. Restoration work shall be at no cost to the Owner and parties having jurisdiction.
- D. All work shall be executed using all precautions necessary to assure safety.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide all materials, equipment, and supplies as required to completely perform the work specified herein and as shown on the Drawings.

2.2 PROTECTION OF DRAINAGE

- A. Refer to SECTION 02 41 19 – SELECTIVE DEMOLITION.

2.3 PROTECTIVE FENCES

- A. Protective fences shall mean construction fences and tree protection fences.
- B. Protective fences shall be chain link fence components including posts, rails, fabric, and miscellaneous accessories. Dimensions and layout shall be as shown on the Drawings. All fence components shall be galvanized. Fence components may be used (second hand) if in good shape.
- C. Contractor shall obtain Owner's approval of all fence components before obtaining fence system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all parts of the area to which EXISTING PLANT MATERIAL DEMOLITION AND PROTECTION is to be installed and the conditions under which the work must be performed. Report in writing to the Contractor, with a copy to the Landscape Architect, any conditions which might adversely affect the installation. Do not proceed with the installation until defects have been corrected and conditions are satisfactory.

3.2 PROTECTION OF EXISTING PLANTS TO REMAIN

- A. The contractor and all subcontractors and employees working on site shall be aware of the following information:
 - 1. Most of a tree's roots are located in the upper few inches of topsoil. For this reason, trees are vulnerable to immediate and long-term damage. Immediate damage to roots is caused by grading, use of vehicles and tools, and excess pedestrian traffic above the roots. Long-term damage is caused by the compaction of the soil above the roots by use of vehicles, storage of materials, and excess pedestrian traffic.
 - 2. Protection of a tree therefore includes the protection of the roots of the tree as well as its trunk, branches, and leaves. Roots are best protected by fencing off as large an area as possible around each tree, so that no driving, parking, walking, or storage of materials takes place where it may cause damage.
 - 3. The roots of a tree often extend far into the surrounding landscape, including areas well beyond the outer perimeter of the tree's canopy. For this reason, operations should be confined to the smallest possible area.
 - 4. As a practical minimum, however, every effort is made to protect the area beneath the canopy of the tree, also known as the area inside the "drip line." This area is sometimes referred to as the "root zone."
 - 5. Soil is most vulnerable to compaction, and roots to damage, when the soil is wet.
- B. Review all fence limits with the Landscape Architect before erecting fences or beginning work.
- C. Erect the tree protection fence before selective demolition, selective tree and plant material removal and pruning or any other construction activity commences. Keep tree protection fence in place until removal is approved by the Landscape Architect and Owner's Representative.
- D. Minor adjustments to the fence layout, which are not represented on the Drawings, might be required to facilitate the work. Minor adjustments shall be made at no additional cost to the project.
- E. Erect the protective fence so that it is securely in place and resistant to ordinary seasonal climatic forces, adjacent pedestrian movement, and work operations.
- F. The Contractor shall periodically inspect, repair and maintain protective fences during the course of construction operations. During periods of construction stoppages, including but not limited to delays and over-wintering, the Contractor shall periodically inspect, repair and maintain protective fences.
- G. The Owner and Landscape Architect reserve the right to require the Contractor to provide additional or more secure tree protection devices if it is determined that the existing trees are not

being properly protected by the Contractor or if the vegetation is threatened with damage through the Contractor's operations.

- H. Temporary access within plant protection areas is permitted to perform construction operations as described on the Drawings. All work within tree protection areas shall be performed by hand or with small equipment that will not damage or threaten damage to trees. All tree protection fencing shall be restored at the end of each day's operation.
- I. If the Landscape Architect determines at any time that trees are not being protected to the standards herein, he may order construction activity to stop immediately and to remain stopped until the non-compliant condition or practice is corrected. The Contractor shall comply with this provision at no additional cost to the Owner. This provision in no way affects the Contractor's obligation to complete the work of this contract by the date specified.
- J. Protect existing trees and other vegetation to remain in place. Do not burn, cut, break, skin, or bruise trunk, roots, or branches. Do not stockpile construction materials and/or excavated materials within drip line of the tree. Do not fasten ropes, cables, or guys to any existing trees unless specifically authorized by the Landscape Architect.
- K. The parking of vehicles, driving of vehicles, storage of materials, removal of soils, and stockpiling of soils within the drip line of trees, including trees located on adjacent properties which overhang the site, is expressly prohibited except as approved by the Landscape Architect, for work directly related to grading revisions as indicated on the drawings.
- L. Utilities: Route utilities away from existing trees even if shown otherwise. Review re-routing with Owner's Representative, Civil Engineer, and Landscape Architect. Do not proceed without written direction. Minimize the cutting of tree roots, and when cutting is unavoidable, cut cleanly with a power saw and not an excavating machine. If cutting is required, comply with "Protection of Tree" specifications included in this Section.
- M. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.
- N. Do not permit water to stand around the base of plants within the drip line during construction operations except during that period of inundating flooding which would, in its natural course, cover the base of trees. The Contractor shall provide temporary drainage where required to avoid ponding during construction operations and after the flood waters have receded below the elevation at the base of each inundated tree.
- O. Provide protection for roots over 1-1/2" diameter cut during construction operations. Roots that are encountered during the course of construction which require cutting shall be cleanly cut with a hand or power saw; cutting of roots with machinery is expressly prohibited. When roots that must be cut are encountered, all work shall cease until roots have been properly cut. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.
- P. Fertilizing: After pruning operations are completed, fertilize trees to increase vigor with a complete, slow release nitrogen, phosphorus, potassium (1:1:1 or 2:1:1) liquid injected fertilizer. Where liquid injected fertilizer is not practical, and when approved by Architect, drill holes 6" to 10" deep and place granular fertilizer at frequent spacing.
- Q. If the Arborist determines that the damaged tree cannot be repaired and restored to full-growth status, the Contractor shall replace the damaged tree(s) and pay liquidated damages as noted below.

1. The Contractor shall purchase a new tree to replace the damaged tree. The size of the tree replacement shall equal $\frac{1}{2}$ " caliper for every 1" DBH of the damaged tree, the new tree shall be based on nursery measurements. The species and source of the replacement tree shall be determined by the Landscape Architect and the Owner's Representative.
2. In addition to providing a new tree replacement, the Contractor shall pay the Owner \$250.00 for every caliper inch of the damaged tree (the size of the damaged tree shall be as shown on the Drawings).
3. An example of the conditions stated above: A 20" DBH tree was damaged and determined to need replacement. To remedy this situation, the Contractor would purchase and install a 10" caliper tree and pay the Owner \$5,000.
4. The total cost of tree replacement, including the cost of the Arborist, shall be borne by the Contractor.

3.3 PROTECTION OF EXISTING IMPROVEMENTS

- A. The Contractor shall provide protections necessary to prevent damage to existing improvements indicated to remain in place and newly constructed improvements on Owner's property.
- B. The Contractor shall protect existing improvements on adjoining properties from any damage.
- C. The Contractor shall restore damaged improvements to their original condition, as acceptable to the Owner's Representative and parties having jurisdiction, at no cost to the Owner and parties having jurisdiction.

3.4 PATCHING AND REPAIRS

- A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction.
- B. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
- C. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.
- D. Patch and repair surfaces in the new areas where demolished surfaces extend one finished area into another. Provide a flush and even surface of uniform color and appearance.
 1. Closely match texture and finish of existing adjacent surface.
 2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
 3. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.
 4. Also refer to SECTION 01 73 29 – CUTTING AND PATCHING.

3.5 DISPOSAL OF WASTE MATERIAL

- A. Burning will not be permitted on the Owner's property.
- B. The Contractor shall remove waste materials, unsuitable and excess materials from the Owner's property and legally dispose of off-site.

- C. The Contractor shall submit the dumpsite owner's name and location of dumpsite to the Owner for approval prior to waste removal from project site.

3.6 POST CONSTRUCTION CLEAN-UP

- A. The Contractor shall completely remove all signs of stockpiles of excess or waste materials, or any other vestiges of construction. Disturbed areas shall be graded and filled with approved soil to a depth of 5" lower than the original contour or new contour as shown on the Drawings. The top layer of soil over the entire area shall be loam 6" thick. The entire area shall be seeded with a lawn seed mix approved by the Landscape Architect.

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, 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, or 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.

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 incorporation.

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. Salvaged Items for Reuse in the Work:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Owner.
 - 4. Transport items to Owner's storage area designated by Owner.
 - 5. Protect items from damage during transport and storage.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

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. Asphaltic Concrete Paving for Fill: If approved by geotechnical engineer, grind asphalt to maximum 1-1/2-inch (38-mm) size.
 - 1. Crush asphaltic concrete paving and screen to comply with requirements in Division 2 Section "Earthwork" for use as general fill.
- B. Asphaltic Concrete Paving for Off-Site Disposal: Break up and transport paving to asphalt-recycling facility.

- C. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - 1. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.
 - 2. Crush concrete and screen to comply with requirements in Division 2 Section "Earthwork" for use as satisfactory soil for fill or subbase.
- D. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - 1. Pulverize masonry to maximum 1-1/2-inch (38-mm) size.
 - a. Crush masonry and screen to comply with requirements in Division 31 Section "Earthwork" for use as general fill.
 - b. Crush masonry and screen to comply with requirements in Division 32 Section "Exterior Plants" for use as mineral mulch.
 - 2. Clean and stack undamaged, whole masonry units on wood pallets.
- E. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

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.
- B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 - 1. Comply with requirements in Division 32 Section "Exterior Plants" for use of chipped organic waste as organic mulch.
- C. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 - a. Comply with requirements in Division 32 Section "Exterior Plants" for use of clean sawdust as organic mulch.
- D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.
 - 1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
 - a. Comply with requirements in Division 2 Section "Exterior Plants" for use of clean ground gypsum board as inorganic soil amendment.

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 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. Procedures related to Architect's additional services if required to complete closeout of Project: Section 011400 – WORK RESTRICTIONS
 - 2. Construction schedule requirements: Section 013200 – CONSTRUCTION PROGRESS DOCUMENTATION.
 - 3. Verification of performance of mechanical and electrical systems: OWNER COMMISSIONING.
 - 4. Temporary facilities to be removed at the end of the Project: Section 015000 – TEMPORARY FACILITIES AND CONTROLS.
 - 5. 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.
- P. Include stripping, sealing, and waxing per Owner's requirements. Refer to technical specifications for additional requirements.

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 therefor. 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 3.05 and 3.06 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.
 10. Flush-out documentation including ATC hourly trending reports.
- 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 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. Subcontractors 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, wherever Work was installed other than as shown on the Contract Drawings or described in the Specifications
 - b. Locations, elevations, sizes, and other like items 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 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 31/32/33 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.

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 and draft agenda 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. Videotape: 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. Video 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 018119
INDOOR AIR QUALITY REQUIREMENTS

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. General procedures for maintaining indoor air quality.
 - 2. Selection of products.
 - 3. Mixing of two-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. Sealing of air intakes during roofing installation: Section 075400 – Thermoplastic Membrane Roofing.
 - 6. 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 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).
 - 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. 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.
4. 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.

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. Isocyanates:
 - 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-preserved-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 like 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 01300 – 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 124800 – 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.
- F. Ventilation:
- 1. Supply temporary construction ventilation. Continuously ventilate during installation of materials that emit Volatile Organic Compounds (VOCs) and after installation of those materials for at least 72 hours or until emissions dissipate. Ventilate directly to outside areas; do not ventilate to other enclosed spaces that are occupied by students, staff, or contractors.

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 Section 310000 – 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. Porous materials such as insulation and gypsum products that have become wet must be removed and discarded regardless of duration.
- 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. Such products must be removed and discarded.
 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 FLUSH-OUT 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. Flush-out shall be completed prior to Substantial Completion.
 - 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 preoccupancy 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.
 - 4. Flush-out shall be completed prior to Substantial Completion.
- 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:
 - 1. The project's specific flushout procedures.
 - 2. Flush-out schedule, start and finish dates.
 - 3. Zone description of defined areas for flushout.
 - 4. List of air handlers within each zone.
 - 5. Filter media used during and after completion of flushout. (Reference Division 230000 specifications).
 - 6. Flushout period calculations.
 - 7. Hourly trending reports from ATC system.

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 02 28 20
ASBESTOS REMEDIATION

PART I - 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 RELATED WORK UNDER OTHER SECTIONS

- A. Environmental Procedures

1.3 DESCRIPTION OF WORK:

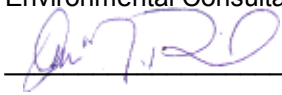
- A. The work includes the complete removal and disposal of all asbestos containing materials (ACM) as indicated in Part 3 of this Section.
- B. The C.M at Risk Contractor shall retain the services of a New Hampshire licensed Asbestos Contractor to perform all required services. The Asbestos Contractor shall include in his scope of work all required services included in Part 3.

1.4 POTENTIAL ASBESTOS HAZARD & DEBRIS

- A. In the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified ACM they must take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies.
- B. If the Asbestos Contractor fails to comply with the requirements of the specifications, the Industrial Hygienist may present a written stop of work order. The Asbestos Contractor must immediately and automatically stop all work until authorized in writing by the Industrial Hygienist to commence work. All costs related to delays shall be at the Asbestos Contractor's expense.

1.5 DEFINITIONS

- A. Abatement: Procedures to control fiber release from ACM. Includes encapsulation, enclosure, and removal.
- B. Air Monitoring: The process of measuring the fiber content of a specific volume of air in a stated period of time.

- C. Asbestos: The name given to a number of naturally occurring hydrated mineral silicates that possess a unique crystalline structure are incombustible and are separable into fibers. Asbestos includes Chrysotile, Crocidolite, Amosite, Anthophyllite, and Actinolite.
- D. ACM: Any material containing more than 1% or greater by weight of asbestos of any type or mixture of types. State laws may vary in their definition of asbestos containing material.
- E. Critical Barrier: A solid, asbestos impermeable partition erected so as to constitute a work area closure; the outer perimeter of an asbestos work area, usually erected across corridors or other open spaces to complete containment.
- F. Designer: State of New Hampshire licensed Designer Ammar Dieb, Universal Environmental Consultants (AD-000374)


- G. Enclosure: All herein specified procedures necessary to complete enclosure of all ACM behind airtight, impermeable, permanent barriers.
- H. Friable Asbestos Material: Material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.
- I. HEPA Filter: A High Efficiency Particulate Absolute (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in length.
- J. Industrial Hygienist: An industrial hygienist certified in the State of New Hampshire to perform project monitoring and air sampling.
- K. Removal: All herein specified procedures necessary to strip all ACM from the designated areas and to dispose of these materials at an acceptable site.
- L. Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.
- M. Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed uncombined water vapor.
- N. Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning tools which have been dampened with water, and by afterwards disposing of these cleaning tools as asbestos contaminated waste.
- O. Work Area: Any area indicated on the Drawings as asbestos abatement areas or as areas containing friable asbestos material.
- P. Worker Decontamination Enclosure System: A decontamination enclosure system for workers, typically consisting of a clean room, a shower room, and an equipment room.

1.6 ASBESTOS CONTRACTOR USE OF PREMISES

- A. Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage sheds to the areas indicated. If additional storage is necessary, obtain and pay for such storage off site.

1.7 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. Provide a full time Site Supervisor with all appropriate state licenses, experienced in administration and supervision of asbestos abatement projects including Work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by 29CFR 1926 for the Asbestos Contractor and is the Asbestos Contractor's representative responsible for compliance with all applicable federal, state and local regulations. This person must have completed a course at an EPA Training Center or equivalent certificate course in asbestos abatement procedures, have had a minimum of two years on the job training and meet any additional requirements set forth in 29 CFR 1926 for a Competent Person. The Site Supervisor must be certified by the State of New Hampshire.
- B. Asbestos Contractor shall provide proof of such certification to the Designer not less than 10 working days (Document Submission Date) prior to commencing any Work. The accredited Supervisor must be at the Work site at all times while Work is in progress.

1.8 SPECIAL REPORTS

- A. Except as otherwise indicated, submit special reports directly to the Industrial Hygienist within one day of occurrence requiring special report, with copies to all others affected by the occurrence.
- B. When an event of unusual and significant nature occurs at the site (examples: failure of negative pressure system, rupture of temporary enclosures, unauthorized entry into work areas), prepare and submit a special report listing date and time of event, chain of events, response by Contractor's personnel, evaluation of results, and similar pertinent information. When such events are known or predictable in advance, advise the Industrial Hygienist in advance at earliest possible date.
- C. Prepare and submit special reports of significant accidents, at the site and anywhere else work is in progress related to this project. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss.

1.9 NOTIFICATIONS

- A. Secure all permits related to asbestos removal, hauling, and disposition and provide timely notification as may be required by federal, state and local authorities including the Health department. Notify the Regional Office of the United States Environmental Protection Agency (USEPA) in accordance with 40 CFR 61.22 (d) (1) and provide copies of the notification to the Designer and the State Environmental Regulatory Agency not later than the Document Submission Date.

- B. No later than the Document Submission Date, notify the local fire and police department, in writing, of proposed asbestos abatement Work. Advise the fire department of the nature of the asbestos abatement Work, and the necessity that all firefighting personnel who may enter the Work site in the case of fire wear self-contained breathing apparatus. Provide one copy of the notices to the Designer prior to commencing the project.
- C. Submit proof to the Designer that all required permits, site location, and arrangements for transport and disposal of ACM have been obtained.

1.10 PERMIT AND COMPLIANCE

- A. The Asbestos Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and local laws, rules, and regulations pertaining to Work practices, protection of Workers, authorized visitors to the site, persons, and property adjacent to the Work.
- B. The Asbestos Contractor shall submit to the Industrial Hygienist the plan for managing the waste including all collection, storage, disposal and decontamination practices/waste disposal.
- C. The Asbestos Contractor must maintain current certificates of training, licenses or registrations pursuant to federal and state regulations for all Work related to this Project, including the removal, handling, transport, and disposal of hazardous and industrial waste.

1.11 SAFETY COMPLIANCE

- A. Comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials.
- B. Comply with the applicable requirements of the current issue of 29CFR 1926.1101 and 40CFR 61, Subparts A and B.

1.12 PERSONNEL PROTECTION

- A. Prior to commencement of work, workers shall be instructed in and shall be knowledgeable of the hazards of asbestos exposure; use and fitting of respirators; use of showers; entry and exit from work areas, and all aspects of work procedures and protective measures.
- B. All abatement workers shall receive training and shall be accredited as required by 40 CFR 763.90(g). Training and accreditation shall be in accordance with 40 CFR 763, Appendix C to Subpart E. Training shall also be provided to meet the requirements of OSHA Regulations contained in 29 CFR 1926.
- C. Prior to the start of work, the Asbestos Contractor shall provide medical examinations for all employees in accordance with 29CFR 1926.1101 (m). All employees hired by the Asbestos Contractor after start of work shall have medical examinations in accordance with this paragraph before being put to work.

- D. Maintain complete and accurate records of employee's medical examinations, during employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of OSHA, the Director of The National Institute for Occupational Safety and Health (NIOSH), authorized representatives of either of them, and an employee's physician upon the request of the employee or former employee.
- E. Provide personnel exposed to airborne concentrations of asbestos fibers with fire retardant disposable protective whole body clothing, head coverings, gloves, and foot coverings. Provide gloves to protect hands. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape. Asbestos Contractor shall require and monitor the use of complete protective clothing. A competent person designated by the Asbestos Contractor in accordance with 29CFR 1926.1101 shall periodically examine protective clothing worn by employees in the work area for rips or tears. When rips or tears are detected, they shall be immediately mended or replaced.
- F. Provide goggles to personnel engaged in asbestos operations when the use of a full-face respirator is not required.
- G. Provide all persons with personally issued and marked respiratory equipment approved by NIOSH and OSHA. The appropriate respiratory protection shall be selected according to the most recent New Hampshire regulations.
- H. Once all visible asbestos material has been removed during decontamination, cartridge type respirators will be allowed during the final cleanup provided the measured airborne concentrations do not exceed 0.1 fibers per cubic centimeter. Where respirators with disposable filters are employed, provide sufficient filters for replacement as required by the worker or applicable regulation.
- I. Select respirators from those approved by the Mine Safety and Health Administration (MSHA), the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services. All personal wearing negative pressure respirators shall have respirator fit tests within the last six months and signed statements shall be available.

1.13 CODES AND REGULATIONS

- A. Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.
- B. The Asbestos Contractor shall assume full responsibility and liability for the compliance with all applicable federal, state, and local regulations pertaining to work practices, hauling, disposal, and protection of Workers, visitors to the site, and persons occupying areas adjacent to the site. The Asbestos Contractor is responsible for providing medical examinations and maintaining medical records or personnel as required by the applicable federal, state, and local regulations. The Asbestos Contractor shall hold the Owner, Designer for failure to comply with any applicable Work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his subcontractors.

1.14 REFERENCE STANDARDS

- A. Unless otherwise indicated, all referenced standards shall be the latest edition available at the time of bidding. Requirements of this Section shall in no way invalidate the minimum requirements of the referenced standards. Comply with the provisions of the following codes and standards, except as otherwise shown or specified. Where conflict among requirements or with this Section exists, the more stringent requirements shall apply.
- B. U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA) requirements, which govern asbestos abatement work or hauling and disposal of asbestos waste materials.
- C. EPA requirements, which govern asbestos abatement work or hauling and disposal of asbestos waste materials.
- D. New Hampshire Department of Environmental Services (DES)
- E. Regulations for Hazardous Waste Management.

1.15 SUBMITTALS

- A. The Asbestos Contractor must submit one emailed copy of a completed submittal to the Designer no later than the Document Submission Date. No Work can commence until all submittals have been approved. The Asbestos Contractor will be required to provide updates as needed.
- B. Submit all required licenses and certification required under MGLC.149 S 44D and 453 CMR 6.00.
- C. Submit a copy of the written respirator program.
- D. Submit manufacturer's certification that vacuums, ventilation equipment, and other equipment required to contain airborne asbestos fibers conform to ANSI Z9.2. Manufacturer's brochures without certifications are not acceptable.
- E. Submit a detailed plan of the Work procedures to be used in the removal of materials containing asbestos. Such plan shall include location of asbestos control areas, decontamination units, layout of decontamination units, location of access routes to asbestos control areas, interface of trades involved in the construction, sequencing of asbestos related Work, disposal plan, type of wetting agent and asbestos sealer to be used, air monitoring, and a detailed description of the method to be employed in order to control pollution.
- F. Submit a plan for emergency actions.

- G. Submit the name, address, and telephone number of the testing laboratory selected for the personal air monitoring of airborne concentrations of asbestos fibers to meet Federal and State OSHA regulations, including Short Term Exposure Limit sampling (STEL). The laboratory must have satisfactorily completed the NIST Proficiency Analytical Testing (PAT) Program and be licensed by the appropriate state agency. Submit the certification that persons counting the samples have been judged proficient by successful completion of the NIOSH 582 course (or equivalent) or be listed in the AIHA Asbestos Analysts Registry (AAR). All OSHA required air monitoring should be done in accordance with the most current NIOSH 7400 method.
- H. Submit the design of the negative pressure system.
 - 1. Number of negative air machines required and the calculations necessary to determine the number of machines.
 - 2. Description of projected airflow within the Work area and methods required providing adequate airflow in all portions of the Work area.
 - 3. Manufacturer's product data and certifications for the machines to be used.
 - 4. Location of machines in the Work area.
 - 5. Location of pressure differential measurement equipment.
 - 6. Manufacturer's product data on equipment used to monitor pressure differential.
- I. Submit for approval the form of security and safety log, which will be maintained on the project.
- J. Submit written evidence that the landfill to be used for disposal of asbestos is approved for disposal of asbestos by the DES.
- K. Submit proof that training requirements as specified in 29CFR 1926.1101 (k) (3) and by appropriate state agencies has been complied with.
- L. Submit a description of the plans for construction of decontamination enclosure systems and for isolation of the Work areas in compliance with this specification and applicable regulations.
- M. Submit a schedule including Work dates, shift time, number of employees, dates of start and completion of all Work, asbestos abatement, inspection and clearance monitoring, each phase of refinishing, and final inspections). Schedule shall be updated with each partial payment request.
- N. Submit copies of all notifications.
- O. Submit copy of asbestos license.
- P. Submit written evidence that the landfill to be used for disposal of asbestos is approved for disposal of asbestos by the DES and EPA.
- Q. Submit Health and Safety Plan per the requirements of OSHA and other applicable regulations.
- R. Submit once work is complete, all disposal waste shipment records and related documents, closure report for ACM.

1.16 REPORTING

- A. Maintain on site a daily log documenting the dates and time of the following items, as well as other significant events:
 - 1. Minutes of meetings: purpose, attendees, and brief discussion
 - 2. Visitations: authorized and unauthorized
 - 3. Personnel: by name, entering and leaving the Work area
 - 4. Special or unusual events
- B. Documentation with confirmation signature of Industrial Hygienist of the following:
 - 1. Inspection of Work area preparation prior to start of removal and daily thereafter.
 - 2. Removal of waste materials from Work area and transport and disposal at approved site.
- C. Provide two bound copies of this log to the Designer prior to submission of the application for final payment.

1.17 AIR MONITORING

- A. Throughout the entire removal and cleaning operations, air monitoring will be conducted to ensure that the Asbestos Contractor is complying with the EPA and OSHA regulations and any applicable state and local government regulations. The architect will provide an Industrial Hygienist (Universal Environmental Consultants) to take air samples at the job site at no cost to the Asbestos Contractor.
- B. The purpose of the air monitoring will be to detect faults in the Work area isolation such as:
 - 1. Contamination of the building outside of the Work area with airborne asbestos fibers,
 - 2. Failure of filtration or rupture in the negative pressure system,
 - 3. Contamination of the exterior of the building with airborne asbestos fibers.
 - 4. Should any of the above occur the Asbestos Contractor should immediately cease asbestos activities until the fault is corrected! Work shall not recommence until authorized by the Designer.

1.18 AIRBORNE FIBER COUNTS

- A. If any air sample taken outside of the work area exceeds the base line established below, immediately and automatically stop all work. If this air sample was taken inside the building and outside of critical barriers around the work area, immediately erect new critical barriers to isolate the affected area from the balance of the building. Erect Critical Barriers at the next existing structural isolation of the involved space (e.g. wall, ceiling, and floor).
 - 1. Decontaminate the affected area in accordance with the procedures outlined in DECONTAMINATION OF WORK AREA.
 - 2. Respiratory protection shall be worn in affected area.
 - 3. Leave critical barriers in place until completion of work and ensure that the operation of the negative pressure system in the work area results in a flow of air from the balance of the building into the affected area.
 - 4. After certification of visual inspection in the work area, remove critical barriers separating the work area from the affected area. Final air samples will be taken within the entire area as set forth in WORK AREA CLEARANCE.

5. A final inspection after removal of poly shall be completed by the Asbestos Contractor's Supervisor and the Industrial Hygienist.
- B. The following procedure will be used to resolve any disputes regarding fiber types when a project has been stopped due to excessive airborne fiber counts. "Airborne Fibers" referred to above include all fibers regardless of composition as counted in the NIOSH 7400 Procedure. If work has stopped due to high airborne fiber counts, air samples will be secured in the same area by the Industrial Hygienist for analysis by electron microscopy. "Airborne Fibers" counted in samples analyzed by Scanning or Transmission Electron microscopy shall be only asbestos fibers, but of any diameter and length. Subsequent to analysis by electron microscopy the number of "Airborne Fibers" shall be determined by multiplying the number of fibers, regardless of composition, counted by the NIOSH 7400 procedure by a number equal to asbestos fibers counted divided by all fibers counted in the electron microscopy analysis.
- C. If Electron microscopy is used to arrive at the basis for determining "Airborne Fiber" counts in accordance with the above paragraph, and if the average of airborne asbestos fibers in all samples taken outside the work area exceeds the base line, then the cost of such analysis will be borne by the Asbestos Contractor, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Plastic Sheet: 9-mil minimum thickness, unless otherwise specified, in sizes to minimize the frequency of joints.
- B. Tape: Capable of sealing joints of adjacent sheets of plastic and for attachment of plastic sheet to finished or unfinished surfaces of dissimilar materials and capable of adhering under dry and wet conditions, including use of amended water. Provide tape, which minimizes damage to surface, finishes.
- C. Cleaning Materials: Use materials recommended by manufacturer of surface to be cleaned. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.
- D. Impermeable Containers: Suitable to receive and retain any asbestos containing or contaminated materials until disposal at an approved site. Containers must be both air and watertight.
- E. Provide metal or fiber drums with tightly fitting lids and double thickness 6 mil plastic bags capable of being sealed, and sized to fit within the drums.

2.02 EQUIPMENT

- A. Supply the required number of asbestos air filtration units to the site in accordance with these specifications. Each unit shall include the following:
 1. Cabinet: Constructed of steel or other durable materials able to withstand damage from rough handling and transportation. Cabinet shall be factory sealed to prevent asbestos containing dust from being released during use, transport, or maintenance. Access to and replacement of all air filters shall be from intake end. Unit shall be mounted on casters or wheels.

2. Fans: Rate capacity of fan according to useable air moving capacity under actual operating conditions. Use centrifugal type fan.
3. HEPA Filters: The final filter shall be the HEPA type. The filter media (folded into closely pleated panels) must be completely sealed on all edges with a structurally rigid frame. A continuous rubber gasket shall be located between the filter and the filter housing to form a tight seal.
4. Each filter shall be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97 percent when challenged with 0.3 μ m dioctylphthalate (DOP) particles. Testing shall be in accordance with Military Standard Number 282 and Army Instruction Manual I36-300-I75A. Each filter shall bear a UL 586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, airflow rating, efficiency and resistance.
5. Prefilters: Prefilters, which protect the final filter by removing the larger particles, are required to prolong the operating life of the HEPA filter. Two stages of prefiltration are required. The first stage prefilter shall be a low efficiency type (e.g., for particles 10 μ m and larger). The second stage (or intermediate) filter shall have a medium efficiency (e.g., effective for particles down to 5 μ m). Prefilters and intermediate filters shall be installed either on or in the intake grid of the unit and held in place with special housings or clamps.
6. Instrumentation: Each unit shall be equipped with a Magnehelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the useable air handling capacity for various static pressure readings on the Magnehelic gauge shall be affixed near the gauge for reference, or the Magnehelic reading indicating at what point the filters should be changed, noting Cubic Feet per Minute (CFM) air delivery at that point. Provide units equipped with an elapsed time meter to show the total accumulated hours of operation.
7. Safety and Warning Devices: The unit shall have an electrical (or mechanical) lockout to prevent fan from operating without a HEPA filter. Units shall be equipped with automatic shutdown system to stop fan in the event of a major rupture in the HEPA filter or blocked air discharge. Indicator lights are required to indicate normal operation, too high a pressure drop across the filters (i.e., filter overloading), and too low of a pressure drop (i.e., major rupture in HEPA filter or obstructed discharge).
8. Electrical Components: Provide electrical components, which are approved by the National Electrical Manufacturers Association (NEMA), and Underwriter's Laboratories (UL). Each unit shall be equipped with overload protection sized for the equipment. The motor, fan, fan housing, and cabinet shall be grounded.

2.03 DANGER SIGNS AND LABELS

- A. Display danger signs at each location where airborne concentrations of asbestos fibers may be in excess of 0.01 fibers/cc. Post signs at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.
- B. The sign shall also contain a pictorial representation of possible danger or hazard, such as a skull and cross bone, or other suitable warning as approved by the Industrial Hygienist. Sign shall meet the requirements of 29CFR 1926.200. A sample of the signs to be used shall be submitted to the Industrial Hygienist for approval prior to beginning work area preparation.
- C. Affix danger labels to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers.

2.04 PERSONNEL DECONTAMINATION UNIT

- A. Prior to any asbestos abatement work, including placement of plastic on walls that will contact or disturb asbestos containing surfaces, or removal of light fixtures or any items on asbestos containing surfaces, construct a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces, Changing Room, Shower Room, and Equipment Room.
- B. Build suitable framing or use existing rooms, with the Industrial Hygienist written approval, connected with framed in tunnels if necessary; line with 6 mil plastic; seal with tape at all lap joints in the plastic for all enclosures and decontamination enclosure system rooms. Decontamination units and access tunnels constructed outside shall be constructed with tops made of 5/8" plywood, or approved equal. In all cases, access between contaminated and uncontaminated rooms or areas shall be through an airlock. In all cases, access between any two rooms within the decontamination enclosure systems shall be through a curtained doorway.
- C. Provide a changing (clean) room for the purpose of changing into protective clothing. Construct using polyethylene sheeting, at least 6-mil in thickness, to provide an airtight seal between the Clean Room and the rest of the building. Locate so that access to work area from Clean Room is through Shower Room. Separate Clean Room from the building by a sheet polyethylene flapped doorway.
- D. Require workers to remove all street clothes in this room, dress in clean disposable coveralls, and don respiratory protection equipment. Do not allow asbestos contaminated items to enter this room. Require workers to enter this room either from outside the structure dressed in street clothes, or naked from the showers.
- E. An existing room may be utilized as the changing room if it is suitably located and of a configuration whereby workmen may enter the Clean Room directly from the Shower Room. Protect all surfaces of room with sheet plastic. Authorization for this shall be obtained from the Industrial Hygienist in writing prior to start of construction.
 - 1. Maintain floor of changing room dry and clean at all times. Do not allow overflow water from shower to wet floor in Changing Room.
 - 2. Damp wipe all surfaces twice after each shift change with a disinfectant solution.
 - 3. Provide a continuously adequate supply of disposable bath towels.
 - 4. Provide posted information for all emergency phone numbers and procedures.
 - 5. Provide 1 storage locker per employee.
 - 6. Provide all other components indicated on the Contract drawings.
- F. Provide a completely water tight operational shower to be used for transit by cleanly dressed workers heading for the work area from the changing room, or for showering by workers headed out of the Work Area after undressing in the Equipment Room.
- G. Construct room by providing a shower pan and 2 shower walls in a configuration that will cause water running down walls to drip into pan. Install a freely draining wooden floor in shower pan at elevation of top of pan.
 - 1. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene.
 - 2. Separate this room from the Clean and Equipment Rooms with airtight walls fabricated of 6-mil polyethylene.
 - 3. Provide showerhead and controls.

4. Provide temporary extensions of existing hot and cold water and drainage, as necessary for a complete and operable shower.
 5. Provide a soap dish and a continuously adequate supply of soap and maintain in sanitary condition.
 6. Arrange so that water from showering does not splash into the Clean or Equipment Rooms.
 7. Arrange water shut off and drain pump operation controls so that a single individual can shower without assistance from either inside or outside of the work area.
 8. Provide flexible hose shower head.
 9. Pump wastewater to drain and provide 20 micron and 5-micron wastewater filters in line to drain or waste water storage. Locate filter hose inside shower unit so that water lost during filter changes is caught by shower pan and pumped to exterior filtering system.
- H. Provide equipment room for contaminated area; work equipment, footwear and additional contaminated work clothing are to be left here. This is a change and transit area for workers. Separate this room from the work area by a 6-mil polyethylene flap doorway.
1. Separate this room from the rest of the building with airtight walls fabricated of 6-mil polyethylene.
 2. Separate this room from the Shower Room and work area with airtight walls fabricated of 6-mil polyethylene.
- I. Separate work area from the equipment Room by polyethylene barriers. If the airborne asbestos level in the work area is expected to be high, add an intermediate cleaning space between the Equipment room and the work area. Damp wipe clean all surfaces after each shift change.

2.05 EQUIPMENT DECONTAMINATION UNITS

- A. In areas with only one access, it may be impossible to utilize a separate Equipment Decontamination Unit. In this case, all equipment and waste materials will exit through the Personnel Decontamination Chambers.
- B. When two accesses to the work area are available, provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms, Clean Room, Holding Room, Wash Room for removal of equipment and material from work area. Do not allow personnel to enter or exit work area through Equipment Decontamination Unit.
- C. Provide an enclosed shower unit located in work area just outside Wash Room as an equipment, bag and container cleaning station.
- D. Provide Wash Room for cleaning of bagged or containered asbestos containing waste materials passed from the work area. Construct Wash Room of 2 by 4 inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and located so that packaged materials, after being wiped clean can be passed to the Holding Room. Separate this room from the work area by flaps of 6-mil polyethylene sheeting, or rigid self-closing doors.
- E. Provide Holding Room as a drop location for bagged ACM passed from the Wash Room. Construct Holding Room of 2 by 4 inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and located so that bagged materials cannot be passed from the Wash Room through the Holding Room to the Clean Room.

- F. Provide Clean Room to isolate the Holding Room from the building exterior. Construct Clean Room of 2 by 4 inch (minimum) wood framing and polyethylene sheeting, at least 6-mil in thickness and locate to provide access to the Holding Room from the building exterior. Separate this room from the exterior by flaps of 6 mil polyethylene sheeting, or rigid self-closing doors.

2.06 DANGER SIGNS AND LABELS

- A. Provide and display danger signs at each location where airborne concentrations of asbestos fibers may be in excess of 0.01 fibers/cc. Post signs at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Post signs at all approaches to Work areas or areas containing excessive concentrations of airborne asbestos fibers.
- B. The sign shall also contain a pictorial representation of possible danger or hazard, such as a skull and cross bone, or other suitable warning as approved by the Designer. Sign shall meet the requirements of 29CFR 1926.1101 (k) (7).
- C. A sample of the signs to be used shall be submitted to the Designer for approval prior to beginning Work area preparation.

PART 3 - EXECUTION

3.01 SCOPE OF WORK:

It is anticipated that the asbestos abatement project will be performed in several phases. It is the Asbestos Contractor's responsibility to comply with the phasing schedule prepared by the Architect and shall comply with the commencement and completion dates allocated. Changing, decreasing and increasing of phases, size, location and scope of work shall not constitute compensation by the Owner or any of his representatives.

The project monitor(s) will record on a daily basis all quantities removed. The Asbestos Contractor will be required to do the same. Both the Asbestos Contractor and the monitor must sign all daily logs. No work will continue until all logs are signed daily to the satisfaction of the Designer and Monitor. At the completion of the total project, should quantities removed were found to be less than the listed below, the Asbestos Contractor will be required to issue a credit to the owner based on unit prices listed in the Unit Price Section or will be paid at the unit prices should quantities removed were found to be greater than the listed below.

Location	Type of ACM	Approximate Quantities
1966 Wing:	9"x 9" Vinyl Floor Tiles and Mastic	80,000 SF
	Ceramic Wall Tiles, Glue and Adhesive	36,000 SF
	Ceramic Floor Tiles, Glue and Paper	42,000 SF
	Window Sill	1,200 LF
	Counter Tops	50 Total
	Lab Drying Racks	10 Total
	Lab Hume Hoods	4 Total
	Sinks	35 Total
	Blackboards	131 Total
	Interior Windows	360 Total

	Interior Doors	400 Total
	Light Fixtures, Thermostats; etc.	1,800 Total
Auditorium	Electrical Wires	150 LF
Kitchen Area	Walk-in Freezers	4 Total
Exterior	Old Windows	12 Total
	Old Caulking/Aluminum Trim	Refer to Drawings
CTC Wing:		
	Interior Windows	20 Total
	Interior Doors	45 Total
Site	Transite Pipe	1,000 LF

Specific Notes:

1. It's the Asbestos Contractor's responsibility to inspect the site and confirm condition prior to the submission of his/her bid package. It is also the Asbestos Contractor's responsibility to review the demolition drawings, notes and phasing configurations. The Asbestos Contractor must include in his/her bid the entire scope of work listed above. Means and methods of removal will be at the discretion of the Asbestos Contractor with prior approval by the onsite monitor and designer.
2. Perform all required demolition, disconnection and retain the services of electricians and plumbers if needed to perform the work at no additional cost to the owner.
3. Remove and dispose as ACM of all types/layers of flooring materials, including but not limited to multiple layers of vinyl floor tiles, linoleum, carpet, resilient baseboard, stair treads, transition strips, leveling compound, cementitious leveler, paper and mastic under all above items. Removal must be done which leave substrate smooth (in similar condition to that which existed prior to Mastic application). Use of Chemicals will be permitted. Once all mastic has been removed, the Asbestos Contractor shall shot blast the concrete floors. Should wood flooring is present the Asbestos Contractor shall remove the wood flooring. The Asbestos Contractor will be required to disconnect services (gas, water, etc.) and remove and dispose of fixed objects to access to ACM. Should ACM found underneath objects not previously removed, the Asbestos Contractor will be required to perform abatement at no additional cost to the owner for re-mobilization. Quantities listed above are for flooring surfaces. The Asbestos Contractor shall remove all layers at no additional cost to the owner.
4. Remove and dispose as ACM of ceramic wall and floor tiles and related glue. Remove fixed items such as panels to access the ACM.
5. Remove and dispose as ACM of window sills.
6. Remove and dispose as ACM of counter tops.
7. Remove and dispose as ACM of lab drying racks.
8. Remove and dispose as ACM of fume hoods/transite panels.
9. Disconnect, remove and dispose as ACM of sinks.
10. Remove and dispose as ACM of transite chalkboards, blackboards, chalkboard, tack board, marker board, display boards, Cementitious wood fiberboard including frame, wood strapping fasteners and ACM glue daub and metal framed chalkboard found behind the wooden chalkboard.
11. Remove and properly dispose of interior windows, doors and doors with windows including but not limited to windows, doors, glass, glass blocks, transom, caulking and all related attachments. Caulking was found to contain asbestos and assumed to contain >1ppm of PCB's.
12. Remove and dispose as ACM of electrical wires. Retain the services of a licensed electrician to disconnect the wires.
13. Disconnect, remove and properly dispose of the freezers.

14. Remove and properly dispose of all old windows, old caulking /aluminum trim, including but not limited to screens, windows, doors, panels, glass, glass blocks, multiple layer of frames, sash, casings, sills, louvers, unit vents grille, shims, fasteners, anchors, sealant, flashing, etc. Wire-brush all adjacent surfaces to insure the complete removal of caulking. Framing and glazing caulking was found to contain asbestos and found to contain <50ppm of PCB's. Refer to drawings. The Contractor shall perform a thorough inspection to determine scope.
15. Remove and dispose as ACM of transite and ACM insulated pipe and debris that might be found during excavation/demolition. The Site/Demolition Contractor will perform excavation as needed to expose the pipe. The Asbestos Contractor will be required to perform additional excavation (if needed) to remove the ACM.
16. Disconnect, remove and properly dispose of light fixtures. Ballasts assumed to contain PCB's and tubes assumed to contain mercury. Retain the services of a licensed electrician.

3.02 JOB CONDITIONS

- A. Do not commence asbestos abatement work until:
 1. Arrangements have been made for disposal of waste at an acceptable site. Submittal shall be made no later than the Document Submission Date.
 2. Arrangements have been made for containing and disposal of wastewater resulting from wet stripping or filtering through a 5-micron filter.
 3. Pre-clean all areas prior to performing the work.
- B. All materials resulting from abatement work, except as specified otherwise shall become the property of the Asbestos Contractor and shall be disposed of as specified herein.

3.03 INSPECTION AND PREPARATION

- A. Examine the areas and conditions under which asbestos will be abated and notify the Industrial Hygienist in writing of conditions detrimental to the proper and timely completion of the work.
- B. Before any work commences, post danger signs in and around the Work Area to comply with 29CFR 1926.1101 (k) (1) as required by federal and state regulations, and as specified herein.

3.04 WORK PROCEDURE

- A. Perform asbestos related work in accordance with 29CFR 1926.1101 and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Personnel of other trades not engaged in the removal and demolition of asbestos shall not be exposed at any time to airborne concentrations of asbestos unless all the personnel protection provisions of this specification are complied with by the trade personnel. Provide and post, in the Equipment Room and the Clean Room, the decontamination and work procedures to be followed by workers, as described hereinafter.

- B. Each worker and authorized visitor shall, upon entering the job site, remove street clothes in the Clean Change Room and put on a respirator and clean protective clothing before entering the equipment room or the work area. All workers shall remove gross contamination before leaving the work area. All clothing (coveralls, head covers, boots, etc.) shall be removed and properly disposed of before leaving equipment room. With the exception of bathing suites and respirators, the workers shall proceed to the Shower Room. Under the shower, respirators shall be removed and cleaned. Cleaned respirators shall be placed in suitable clean plastic bags and carried by employees to Clean Room. Soap, towels, etc., shall be furnished by the Asbestos Contractor. The Asbestos Contractor shall maintain proper sanitary conditions. The Asbestos Contractor's designated competent person shall insure that these practices are being adhered to.
- C. Following showering and drying off, each worker and authorized visitor shall dispose of towels as contaminated waste, and proceed directly to the Clean Change Room and dress in clean clothes at the end of each day's work, or before eating, smoking, or drinking. Before re-entering the work area from the Clean Change Room, each worker and authorized visitor shall put on the applicable respirator and shall dress in clean protective clothing. Contaminated work footwear shall be stored in the equipment room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste.
- D. Contaminated work footwear shall be stored in the equipment room when not in use in the work area. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or double bag for use at next site.
- E. Workers removing waste containers from the Equipment Decontamination Enclosure shall enter the holding area from outside wearing a respirator and dressed in clean coveralls. No worker shall use this system as a means to leave or enter the washroom or the work area.
- F. Workers shall be fully protected with respirators and protective clothing immediately prior to the first disturbance of asbestos containing or contaminated materials and until final cleanup is completed. This includes the removal of any equipment in contact with ACM such as lights, HVAC grills, etc.

3.05 PREPARATION OF THE WORK AREA

- A. Seal off the work area by sealing large openings such as open doors, elevator doors, and passageways with a critical barrier. The critical barrier shall constitute the outermost boundary of the asbestos abatement project work area. Plastic sheeting on open framing is not a suitable critical barrier. Critical barriers may be erected of a suitable solid construction material such as plywood, sheet-rock, gypsum board, or other related materials.
- B. Prior to any asbestos abatement work, clean the proposed work areas using HEPA filtered vacuum equipment and wet cleaning methods as appropriate. Methods that raise dust, such as dry sweeping or vacuuming with equipment not equipped with HEPA filters will not be permitted. Dispose of all cloths, which are used for cleaning as contaminated waste.
- C. Place all tools, scaffolding, staging, etc. necessary for the work in the area to be isolated prior to erection of plastic sheeting temporary enclosure.

- D. Shut down electric power. Provide temporary power and lighting and ensure safe installation of temporary power sources and equipment per applicable electrical code requirements. Provide 24 volt safety lighting and provide ground-fault interrupter circuits as power source for lights and electrical equipment.
- E. Seal off all openings, including but not limited to corridors, doorways, windows, skylights, ducts, grills, diffusers, and any other penetrations of the work areas, with 6-mil plastic sheeting and sealed with tape.
- F. Prior to any abatement activities seal all floor and ceiling openings or penetrations that have not already been sealed. This includes penetrations through ceiling and floor slabs, both empty holes and holes accommodating items such as cables, pipes, ducts, conduit, etc.; and expansion joints in floors and wall and floor slab assemblies.
- G. Use combination fire stop foam and fire stop sealant equivalent to Dow Corning Fire Stop Foam and Dow Corning Fire Stop Sealant. Material shall be applied in accordance with manufacturer's recommendations.
- H. Maintain emergency and fire exits from the work areas, or establish alternative exits satisfactory to the local fire officials. Coordinate work with local fire and police departments, and Industrial Hygienist.
- I. Shut down and isolate heating, cooling, ventilating air systems in the contaminated areas to prevent contamination and fiber dispersal to other areas of the structure. During the work, seal vents within the work area with solid barriers, such as plywood and tape and plastic sheeting, or as indicated on the drawings.
- J. Remove all HVAC system filters. Pack disposable filters in sealable double 6 mil plastic bags for burial in the approved waste disposal site; replace with new filters after final cleanup. Wet clean permanent filters; reinstall after final cleanup.
- K. Before work is begun, clean all items, which can be removed without disrupting the asbestos material. Pre-clean movable furniture, [carpeting, clocks, speakers, books, and other objects] within the proposed areas using HEPA filtered vacuum equipment and/or wet cleaning methods as appropriate; remove such objects from work areas to a temporary location as directed by the Industrial Hygienist.
- L. Pre-clean non-removable furniture, book shelving, equipment, heat fans, fire alarms, pipes, ductwork, wires and conduits, lockers, skylights, speakers, and other fixed objects within the proposed work areas, using HEPA filtered vacuum equipment and wet cleaning methods as appropriate prior to abatement activities, and enclose with minimum 6 mil plastic sheeting sealed with tape.
- M. Remove and clean all ceiling mounted objects, such as lights, HVAC grills, etc. and other items not previously sealed off, that interfere with asbestos abatement. Use localized water spraying or HEPA filtered vacuum equipment during fixture removal to reduce fiber dispersal.

3.06 MAINTENANCE OF ENCLOSURE SYSTEMS

- A. Ensure that barriers and plastic linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery. Visually inspect enclosures at the beginning of each work period.

- B. Use smoke methods to test effectiveness of barriers when directed by the Industrial Hygienist.

3.07 CONTROL ACCESS:

- A. Permit access to the work area only through the Decontamination Unit. All other means of access shall be closed off, warning signs displayed on the clean side of the sealed access.
- B. Large openings such as open doorways and passageways shall be sealed as a critical barrier. The critical barrier shall constitute the outmost boundary of the asbestos abatement work area.
- C. Plastic sheeting on open framing is not a suitable critical barrier. All cracks, seams, and openings in critical barriers shall be caulked or otherwise sealed, so as to prevent the movement of asbestos fibers out.

3.08 ISOLATION OF WORK AREA:

- A. Completely separate the work area from other portions of the building, and the outside by sheet plastic barriers at least 6 mil in thickness, or by sealing with duct tape.
- B. Individually seal all ventilation openings (supply and exhaust), lighting fixtures, clocks, doorways, windows, convectors and speakers, and other openings into the work area with duct tape alone or with polyethylene sheeting at least 6-mil in thickness, taped securely in place with duct tape. Maintain seal until all work including work area decontamination is completed. All lighting fixtures shall have had power shut off.
- C. Provide sheet plastic barriers at least 6 mil in thickness as required to completely seal openings from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape.

3.09 COVERING OF FLOOR AND WALL SURFACES

- A. Clean all contaminated furniture, equipment, and or supplies with a HEPA filtered vacuum cleaner or by wet cleaning prior to being moved or covered. All equipment, furniture, etc. in work area is to be deemed contaminated unless specifically declared as uncontaminated on the Drawings or in writing by the Industrial Hygienist. Clean all surfaces in work area with a HEPA filtered vacuum or by wet wiping prior to the installation of any sheet plastic.
- B. Cover floor of work area with 2 individual layers of clear polyethylene sheeting, each at least 6 mil in thickness, turned up walls at least 12 inches. Form sharp right angle-bend at junction of floor and wall so that there is no radius, which could be stepped on causing the wall attachment to be pulled loose. Duct tape all seams in floor covering. Locate seams in top layer six feet from, or at right angles to, seams in bottom layer. Install sheeting so that top layer can be removed independently of bottom layer.
- C. Remove all general construction items such as cabinets, casework, doors and window trim, moldings, ceilings, trim, etc., which cover the surface of the work as required to prevent interference with the work. Clean, decontaminate and reinstall, unless otherwise indicated, all such materials, upon completion of all removal work with materials, finishes, and workmanship to match existing installations before start of work.

- D. Cover all walls in work area with two (2) layers of polyethylene sheeting, at least 6- mil in thickness, mechanically supported and sealed with duct tape. Tape all joints including the joining with the floor covering with duct tape or as otherwise indicated on the Contract documents or in writing by the Industrial Hygienist. There shall be no seams in the plastic sheet at wall to floor joints.
- E. If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, then add affected area to the work area, enclose it as required by this section and decontaminate it as specified herein.

3.10 NEGATIVE PRESSURE

- A. Establish negative pressure in the work area by installation of High Efficiency Particulate Air (HEPA) filter air-purifying devices. Comply with ANSI Z9.2, Local Exhaust Ventilation Requirements. Maintain system in operation 24 hours per day until decontamination of the work area is completed and area has been certified clean by air monitoring tests and visual inspections. Discharge of asbestos fibers to the outside of the building will not be permitted.
- B. Size negative air pressure system(s) to provide a minimum of one air change every 15 minutes for the area under negative pressure. Locate the exhaust unit(s) so that makeup air enters the work area primarily through the decontamination unit and traverses the work area as much as possible. The intent is to provide the air change specified in each work area (room), not just the specified negative pressure. Place the end of the unit or its exhaust duct through an opening in the plastic barrier or wall covering. Seal the plastic around the unit or duct with tape.
- C. The system shall maintain an air pressure differential of minus 0.02 inch of water. Test the negative pressure system prior to any abatement actions to insure that the 0.02-inch differential is present. The Industrial Hygienist may require the use of ventilation smoke tubes to check the system performance.

3.11 REMOVAL OF ASBESTOS CONTAINING MATERIALS

- A. Thoroughly wet ACM to be removed prior to stripping to reduce fiber dispersal into the air. Accomplish wetting by a fine spray (mist) of amended water or removal Encapsulant. Saturate material sufficiently to wet to the substrate without causing excess dripping. Allow time for water or removal Encapsulant to penetrate material thoroughly. If a removal Encapsulant is used, apply in strict accordance with manufacturer's written instructions.
- B. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
- C. Remove saturated ACM in small sections from all areas. Do not allow material to dry out. As it is removed, simultaneously pack material while still wet into disposal bags. Twist neck of bags, bend over and seal with minimum three wraps of duct tape. Clean outside and move to wash down station adjacent to material decontamination unit.
- D. For the removal of pipe and joint insulation, the density of asbestos containing pipe covering seldom allows the material to be removed in a completely wet state. However, every attempt should be made to keep the insulation material as wet as possible to prevent release of asbestos fibers.

- E. Cut the cloth covering on the pipe insulation along the top seam to allow wetting of the asbestos insulation. Do not allow the pipe insulation to fall to the ground or adjacent surfaces. Wet the insulation material and immediately place in a double 6 mil, minimum thickness labeled plastic bag.

- F. In certain areas, asbestos pipe insulation will be removed with glove-bags (with prior approval by the Industrial Hygienist).
 - 1. Seal all critical barriers.
 - 2. Pre-clean if necessary and place one layer of polyethylene under the pipe to be removed.
 - 3. Negative air machines with HEPA filtration will be used in the area.
 - 4. Glove bags will be smoke tested.
 - 5. Place necessary tools into pouch located inside glove-bag. This will usually include: bone saw, utility knife, rags, scrub brush, wire cutters, tin snips and pre-wetted cloth.
 - 6. Place one strip of duct tape along the edge of the open top slit of glove-bag for reinforcement.
 - 7. Place the glove bag around section of pipe to be worked on and staple top together through reinforcing duct tape. Next, duct tape the ends of glove-bag to pipe itself, where previously covered with plastic or duct tape.
 - 8. Place additional layers of tape along the top of the glove-bag to seal the staple holes and to securely support the bag on the pipe.
 - 9. Fill each bag with 2 inches of water to thoroughly wet the removed insulation.
 - 10. Attach vacuum hose through port in bag and tape tightly to prevent leakage.
 - 11. Insert spray nozzle into bag and tape tightly to prevent leakage.
 - 12. One person places his hands into the long-sleeved gloves while the second person directs garden sprayer at the work.
 - 13. Use bone saw, if required, to cut insulation at each end of the section to be removed. A bone saw is a serrated heavy gauge wire with ring-type handles at each end. Throughout this process, spray amended water or removal Encapsulant on the cutting area to keep dust to a minimum.
 - 14. Remove insulation using putty knives or other tools. Place pieces in bottom of bag without dropping.
 - 15. Using nylon scrub brush, rags, and water scrub and wipe down the exposed pipe.
 - 16. Wipe down the inside of the bag with the rags. Remove the water nozzle and tape shut.
 - 17. Encapsulate the exposed ends and cover any exposed ends of pipe insulation with the re-wettable clothe. This shall be done prior to removing the bag.
 - 18. Place the cleaned tools either into the next glove bag or put into the glove and pulled out. Twist the glove, tape at least twice and cut through the tape. The tools can be dropped into a bucket of water to clean them.
 - 19. Twist the bag several times and turn on HEPA vacuum to remove the air. Tape the twist several times.
 - 20. Slip a 6-mil disposal bag under the glove-bag and while running the vacuum sufficiently to collapse the bag, cut the glove-bag off.
 - 21. Encapsulate all exposed pipe and elbows to lock down any remaining fibers.
 - 22. Remove disposable suits and place these into bag with waste.
 - 23. Collapse the disposal bag with a HEPA vacuum, twist top of bag, seal with at least 3 wraps of duct tape, bend over and seal again with at least 3 wraps of duct tape.

3.12 DECONTAMINATION OF WORK AREA

- A. Maintain premises and public properties free from accumulation of waste, debris, and rubbish, caused by operations. Remove visible accumulations of asbestos material and debris. Wet clean all surfaces within the work area.
- B. Remove the plastic sheets from walls and floors only. Take proper care in folding up plastic sheeting to minimize dispersal of residual asbestos containing debris.
- C. Leave the windows, doors, and HVAC vents sealed. Maintain HEPA filtered negative air pressure systems, air filtration and decontamination enclosure systems in service.
- D. Remove all debris from floor of work area. This includes all trash, scraps of lumber, pipes, etc. and all visible asbestos debris. The asbestos debris is primarily deteriorated pipe insulation that has fallen to the ground. Dispose of all debris removed as asbestos contaminated waste. HEPA vacuum the entire floor.
- E. Clean all surfaces in the work area and any other contaminated areas with water and with HEPA filtered vacuum equipment. After cleaning the work area, wait 24 hours to allow for settlement of dust, and again wet clean and clean with HEPA filtered vacuum equipment all surfaces in the work area. After completion of the second cleaning operation, perform a complete visual inspection of the work area to ensure that the work area is free of visible asbestos debris. The negative pressure system may be shut down only after clean air has been achieved.
- F. Include sealed drums and all equipment used in the work area in the cleanup and remove from work areas, via the equipment decontamination enclosure system, at an appropriate time in the clean sequence.
- G. Conduct cleaning and disposal operations to comply with applicable ordinances and antipollution laws. Do not burn or bury rubbish and waste materials on job site. Do not dispose of volatile wastes in storm or sanitary drains. Do not dispose of wastes into streams or waterways.
- H. Store volatile wastes in covered metal containers during work hours and remove from premises at end of workday. Prevent accumulation of wastes, which create hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.
- I. If the Industrial Hygienist, within 24 hours after the second cleaning, finds visible accumulations of asbestos debris in the work area, repeat the wet cleaning until the work area is in compliance, at no additional expense to the Owner.
- J. Remove the first layer of plastic sheet from walls and floors only. Take proper care in folding up plastic sheeting to minimize dispersal of residual asbestos containing debris.
- K. Leave the windows, doors, and HVAC vents sealed. Maintain HEPA filtered negative air pressure systems, air filtration and decontamination enclosure systems in service.

- L. Following the final visual inspection by the IH, after the removal of asbestos-containing materials and decontamination of work areas, and while space enclosures systems remain in place, seal all surfaces from which asbestos-containing material have been removed to assure immobilization of any remaining fibers. Use a colored sealant so that complete coverage may be ensured by a visible inspection by the IH to verify that asbestos-containing material has been adequately removed. Apply sealer in accordance with manufacturer's recommendations using airless spray equipment.
- M. Clearance air samples will be taken by the IH using aggressive air sampling. Analysis will be made using Phase Contrast Microscopy or Transmission Electron Microscopy.
- N. Clean and decontaminate of all access routes used to transport ACM debris.

3.13 WORK AREA CLEARANCE

- A. The work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below. When this has occurred, the Asbestos Contractor will notify the Industrial Hygienist that the area is ready for clearance.
- B. The number and volume of air samples taken and analytical methods used by the Industrial Hygienist will be in accordance with applicable regulations.
- C. The Owner will pay for the initial testing required for clearance. Should the initial testing fail, the Asbestos Contractor will reimburse the Owner for the cost of all additional testing based on \$90.00 per hour for Industrial Hygienist, \$30.00 per each PCM.

3.14 DISPOSAL OF ACM AND ASBESTOS CONTAMINATED WASTE

- A. To prevent exceeding available storage capacity on site, remove sealed and labeled containers of asbestos waste and dispose of such containers at an authorized disposal site in accordance with the requirements of disposal authority.
- B. Comply with 29 CFR 1926.1101.
- C. Seal all asbestos and asbestos contaminated waste material with double thickness 6-mil, sealable plastic bags. Label the bags; transport and dispose of all in accordance with the applicable OSHA and EPA regulations. At the conclusion of the job, place all polyethylene material, tape, cleaning material and clothing in the plastic lined drum. Seal, correctly label, and dispose of as asbestos waste material.
- D. Transport the bags to the approved waste disposal site. Asbestos Contractor shall obtain trip tickets at the landfill to document disposal of asbestos containing materials. A form shall be signed, not initialed, by all parties. Copies of all trip tickets shall be submitted to the Industrial Hygienist.
- E. If a rental vehicle is used to transport asbestos waste, Asbestos Contractor shall provide to the vehicle's owner a written statement as to the intended use of the vehicle. A copy of such notice, signed by the vehicle owner, shall be provided to the Industrial Hygienist prior to transporting materials in the vehicle. Two layers of 6-mil plastic sheet shall be placed on the floor and walls of the rental vehicle prior to loading any containers of asbestos waste.
- F. Consider wastewater from showers and sinks to be contaminated waste and dispose of in accordance with this Section, unless water has been filtered through a 5 micron filter.

3.15 DISPOSAL OF NON-CONTAMINATED WASTE

- A. Remove from the site all non-contaminated debris and rubbish resulting from demolition operations. Transport materials removed from demolished areas and dispose of off site in a legal manner.
- B. During progress of work, clean site and public properties, and dispose of waste materials, debris, and rubbish. Provide on-site containers for collection of waste materials, debris, and rubbish. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

3.16 FINAL CLEAN UP

- A. Employ experienced workers or professional cleaners for final cleaning. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from exposed to view interior and exterior finished surfaces. Polish surfaces so designated.

3.17 ALTERNATE CONTAINMENT SYSTEM

- A. In lieu of the containment system previously described consisting of a decontamination enclosure system utilizing curtained doorway, and a negative air system to exhaust sufficient air to achieve one air change every 15 minutes, the following system will be allowed:
- B. Construct a decontamination unit consisting of a totally enclosed Equipment Room, Shower Room, Air Locks, and Clean Room as described above except that instead of curtained doorways between rooms, doorways shall be solid core rigid wooden or fiberglass doors. Door at entrance into Clean Room from the uncontaminated area shall contain a HEPA filter. This doorway shall have gasketed seals around the HEPA filter and the edges of the door to provide a tight seal. HEPA filter shall be mounted in the door securely using a mechanical fastening system. Each door shall be equipped with a self-closing mechanism.
- C. Negative pressure units as described previously shall be utilized to create a pressure differential of 0.02 inches of water between the work area and the outside uncontaminated area. Only the required air volume to create the negative pressure shall be exhausted through the HEPA filter unit outside the work area. Additional HEPA filter units shall be located within the work area to provide for air circulation.

END OF SECTION

SECTION 024119

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.
- 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 DESCRIPTION OF WORK

A. Work Included:

- 1. Demolition and complete removal of buildings, and structures and as required for new work. Refer to the Drawings for additional requirements.
- 2. 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.
- 3. Maintenance, watering and care of trees designated to remain by a certified arborist during the construction period.
- 4. Demolition and removal work shall properly prepare for alteration work and new construction to be provided under the Contract.
- 5. Scheduling and sequencing operations without interrupt 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. Related Work:

- 1. Section 011400 – WORK RESTRICTIONS:
 - a. Maintenance of access, cleaning during construction, dust and noise control.
- 2. Section 017400 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL:
 - a. Waste management and recycling.
- 3. Division 21 - FIRE PROTECTION:
 - a. Disconnecting, capping and otherwise making inactive existing mechanical services to building. Removal and disposal of such materials shall be then done under this Section 024119 - DEMOLITION.
- 4. Division 22 - PLUMBING:

- a. Disconnecting, capping and otherwise making inactive existing mechanical services to building. Removal and disposal of such materials shall be then done under this Section 024119 - DEMOLITION.
5. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
 - a. Disconnecting, capping and otherwise making inactive existing mechanical services to building. Removal and disposal of such materials shall be then done under this Section 024119 - DEMOLITION.
6. Division 26 - ELECTRICAL WORK:
 - a. Disconnecting, capping and otherwise making inactive existing electrical services to building. Removal and disposal of such materials shall be then done under this Section 024119 - DEMOLITION.
7. Section 312000 - EARTH MOVING:
 - a. Excavating and removal of existing pavement, sub-surface building and utility structures and lines, appurtenances, and other elements indicated on the Drawings.
8. Section 311000 SITE CLEARING
9. Section 329300 PLANTS
10. Refer to Boring and Test Pit Reports for additional information relating to subsurface conditions.

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 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 Demolition Activities: Indicate the following:
 1. Detailed sequence of 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. Means of protection for items to remain and items in path of waste removal from building.

- B. Inventory: After 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 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 AND DISPOSAL.

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 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 demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize 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 demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

PART 2 - PRODUCTS

2.1 SALVAGING

- A. Salvaged for Reinstallation: Materials 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. Lockers.
- 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. TBD.

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 demolition required.
- C. Inventory and record the condition of 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 demolition operations.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction videotapes.
 - 1. Before 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 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 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 demolition provide temporary services/systems that bypass area of 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 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 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 DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction including but not limited to the entire existing building and ancillary buildings including building foundations as indicated on drawings. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with demolition systematically, from higher to lower level. Complete demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. 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.
 3. Maintain adequate ventilation when using cutting torches.
 4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 6. Locate demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 7. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 - CONSTRUCTION WASTE MANAGEMENT AND DEMOLITION.
 8. Existing furnishings and equipment: Except for items indicated to be salvaged, the Owner intends to remove all loose furnishings and equipment from the building prior to the start of demolition. All items, other than salvaged items, that remain in the building after the scheduled start date for demolition shall be removed and properly disposed of by the Contractor.
- B. Below-Grade Construction: Demolish foundation walls and other below-grade construction as follows:
1. Remove existing foundation walls to not less than two feet below final surface grade or as required for landscaping, site/civil or utility work, whichever is deeper.
 2. Slabs which extend below 2 feet shall be broken-up in-place.
- C. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified in Section 312000, EARTHWORK.
- D. Removed and Salvaged Items:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to storage area designated by the Owner.
 5. Protect items from damage during transport and storage.
- E. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse. 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.
- F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during 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.
- G. 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. Refer to Division 32 for additional requirements.
- 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 DISPOSAL 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 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 SUMMARY

- A. 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. Furnishing and installation of joint fillers.
 - 6. Setting of anchor bolts and grouting of leveling plates and bearing plates.
 - 7. Grouting anchor rod oversize holes at column base plates.
 - 8. Furnishing and installation of mastic coating on embedded structural steel.
 - 9. 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.
 - 10. Hardening and sealing of exposed concrete floors.
 - 11. Coordination of floor slab finish requirements with flooring manufacturers and contractors.
 - 12. As-built surveys of concrete floor slab elevations.
 - 13. Leveling of concrete slabs with a self-leveling concrete underlayment if required to meet the specified tolerances.
- 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 07 95 13 EXPANSION JOINT COVER ASSEMBLIES: Expansion joint covers, as indicated on the Drawings.

1.3 RELATED SECTIONS

- A. Related work shall be performed under the following Sections:
1. Section 033300 - ARCHITECTURAL CONCRETE.
 2. Section 033650 - CONCRETE FINISHES.
 3. Section 042000 - UNIT MASONRY.
 4. Section 051200 - STRUCTURAL STEEL FRAMING.
 5. Section 051226 - SHEAR CONNECTORS.
 6. Section 053100 - STEEL DECKING.
 7. Section 070001 - WATERPROOFING, DAMPPROOFING AND CAULKING.
 8. Section 072100 - THERMAL INSULATION.
 9. Section 079200 - JOINT SEALANTS.
 10. Section 099000 - PAINTING AND COATING.
 11. Section 310000 - EARTHWORK.

1.4 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.

1.5 LEED BUILDING – GENERAL REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental goals, which include achieving a LEED Building Silver rating under the "U.S. Green Building Council's (USGBC) LEED for Schools, Version 2009". Specific project goals which may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes substantially compromise the stated LEED BUILDING criteria.

B. LEED BUILDING Performance Criteria: The following criteria are required for the products included in this section:

1. Steel shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
2. Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.

1.6 SUBMITTALS

A. LEED Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018110 – 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 018110.
2. Show installed costs of all items listed.

B. 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, and other concrete elements. 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 Structure" and show following: detailed, scaled and dimensioned elevations of each and every wall/foundation, etc... are required; 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, and all related work are the sole responsibility of the Contractor.

- 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 subject to the following conditions:
 - (1) The entity producing the Shop and Coordination Drawings (The “User”) agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 - (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 - (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.
- 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 2.2B.
- 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; 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 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: Refer to Section 033300 – ARCHITECTURAL CONCRETE.
- C. Provide concrete Mix Data as specified in Paragraph 2.2B.
 - D. Provide manufacturer's data for other products.
 - E. 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.
 - F. 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.
 - G. Provide percentage of recycled content by weight including fly ash (20%) and recycled content.
- 1.7 LEED SUBMITTALS
- A. The contractor, subcontractor, and/or product manufacturer shall submit LEED BUILDING certification items in accordance with Section 018110 – SUSTAINABLE BUILDING REQUIREMENTS.
- 1.8 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. Concrete floor slabs shall be prepared in accordance with ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- G. All reinforcing shall be inspected by the testing agency for grade, size, spacing, position, cleanliness, cover and support.
- H. Cooperate with the testing agency's work and provide help 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.
- I. Compression tests shall consist of four (4) - 6" diameter by 12" long cylinders (or six (6) - 4" diameter by 8" long 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. For each test made, one (1) cylinder shall be tested at 7-days test sample age and two (2) 6" diameter cylinders (three (3) for 4" diameter cylinders) shall be tested at 28-day test sample age. One 6" diameter cylinder (or two 4" diameter cylinders) for each test shall be kept in the event that a 56-day sample age test is required due to low 28-day results. Concrete for each set of cylinders shall be from one (1) sample representative of the entire batch.
- J. 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.

K. 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.
- L. 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.
- M. Accept as final, results of tests made by the qualified professional testing organization engaged by the Owner.
- N. 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.
- O. 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.

1.9 NOTIFICATION OF RELATED TRADES

- A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers, and at similar locations 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, and similar penetrations for mechanical and electrical work, as shown on Drawings or required by layout of mechanical systems.

1.10 SAMPLE PANELS

- A. Prepare sample panels for exposed concrete. Refer to Section 033300 – ARCHITECTURAL CONCRETE.

1.11 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of SECTION 013300 – SUBSTITUTION PROCEDURES 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 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 for exposed Architectural concrete shall be specially selected for light color approved by the Architect and shall come from a

single source. Stockpile sufficient quantities to assure continuous supply. Coarse aggregate shall meet the following additional requirements:

Fineness Modulus: (+/- 0.20) 6.70 and 5.5 respectively

Organic: Plate 1 maximum.

Silt: 1.0 % maximum

Soundness: 5% - 8% maximum loss, magnesium sulfate, five cycles.

2. Fine Aggregate: Shall be sand, clean, hard, durable, uncoated grains, free from silt, loam and clay, to meet ASTM C 33. Fine aggregate for exposed, Architectural concrete shall be specially selected for light color approved by the Architect, and shall come from a single source. Stockpile adequate amounts of fine aggregate to assure continuous supply. 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.

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. Concrete Reinforcement

1. Reinforcing steel shall conform to ASTM A 615 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.

F. 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. 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.
3. Forms for smooth surfaces exposed to view (not labeled as Architectural Exposed Concrete) or to receive a skin coat of plaster and/or paint shall be smooth and subject to approval of the architect by way of a mockup test panel.
4. Form release agent shall be of a non-staining type, specifically manufactured for concrete forms.
5. 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.
6. 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.
7. 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.

- G. 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.

H. 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 an equal approved by the Architect.
2. For feather finish areas use Ardex SD-F 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.

I. Surface Conditioners:

1. Floor Hardener for exposed concrete floors shall be "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.

J. 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 Flex" by W.R. Meadows, "Dura 340" by Euclid Chemical Company, "Joint Tite 750" by L&M Construction Chemicals, or an equal approved by the Architect.
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 an equal as approved by the Architect.
6. Non-Shrink Grout: Grout at column and beam bearing shall be "MasterFlow 100" by BASF, "SonogROUT 10K" by Sonneborn ChemRex. "Five Star Grout" by Five Star Products, Inc. or equal approved by the Architect.
7. Anchor Rod Base Plate Grout: Grout in oversize anchor rod holes at brace column steel base plates shall be "MasterFlow 816" by Master Builders, "Five Star Fluid Grout PT" by Five Star Products, Inc., "Quikrete Cable Duct Grout" by Quikrete, or equal approved by the Architect.
8. 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.
9. Mastic coating of structural steel below the top of slab on grade elevation shall be a high-build coal tar epoxy mastic as manufactured by Carboline, Inc., Sumter Coatings, Inc., Rust-Oleum, Inc., Krylon Industrial Coatings, Inc., or an equal approved by the Architect.
10. Concrete curing covers shall be "Hydracure" by PNA Construction Technologies, "Transguard 4000" by Reed Industries, "UltraCure DOT" by McTech Group, or an equal approved by the Architect.

2.2 CONCRETE MIXES

A. Strength, cement and water requirements:

Design Compr. <u>Strength, f'c</u>	Min. Cement Factor* <u>Sacks/yd3 lbs/yd3</u>		Max. Water Cement Ratio <u>Gal/sack Gal by wt.</u>	
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 concrete with a strength of 4000 psi or higher 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 1.5%. 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 1.5%. 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). The maximum water-cement ratio for slabs on grade or slabs on steel deck is limited to 0.44. 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. Concrete for slabs on grade and slabs on steel deck shall include a 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".
- 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, and other embedded items, and secure properly.
- C. Conduits and Pipes by M.E.P. Contractors: Embed no pipes other than electrical conduit in structural concrete. Provide steel pipe sleeves for pipes passing through. Embed conduit in concrete only under the following conditions:
1. No conduit coating, except galvanizing or equivalent shall be used. Do not embed aluminum conduit in concrete.
 2. Do not cut or displace any reinforcement.
 3. Place conduit within the middle half of any member. Do not place conduit between concrete surfaces and reinforcement.
 4. Structural slabs (refers to formed slabs not toppings on metal deck) - Restrict O.D. of conduit to less than 1/4 of slab thickness. Place within middle of slab thickness.

5. Place conduit larger than 1/6 formed slab thickness parallel and at right angles to slab reinforcing, not diagonally.
6. Place nearly parallel conduits apart at least 3 times O.D.
7. Do not embed conduit over 4 percent of the gross concrete area lengthwise in beams or columns.
8. Do not place conduit in concrete toppings 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:	15 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 or metal forms.

- E. Isolation joint fillers shall be installed with removable top snap-caps so that the joint filler material to remain is 1/2" below the top surface of the slab to allow for joint sealants.

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. Horizontal construction joints including those for toppings shall be mechanically roughened and cleaned thoroughly of all foreign materials and laitance, roughen with suitable tools such as chipping hammers or wire brushes, reclean by stream of water or compressed air and an approved bonding agent shall be used in accordance with the manufacturer's recommendations. New concrete shall be deposited before the bonding agent dries out.

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. Surfaces to Receive Sandblast Finish: Upon completion of operations under the preceding paragraph, sandblast all exterior vertical surfaces and all other surfaces indicated as receiving sandblast finish. No interior surfaces shall be sandblasted. Use a #400 gradation abrasive that will not adversely affect the color of the finished surface, such as "Black Beauty" supplied by M. B. Reed and Company, Inc., Hammond, Indiana, "Garnet Sand" supplied by Davidson MacDonald, Boston, Massachusetts, or approved equal. Abrasive blasting shall be carried out to the same depth and produce the same texture as the accepted sample panel throughout. Sandblasting shall be done after all concrete to be blasted has attained a strength of 3,000 psi as determined by field control cylinders, or after a minimum of seven (7) days, whichever is first. The Contractor shall be responsible for safety of the workmen and for any damage or claims resulting from this operation and shall equip each person with an air-fed helmet. Provide suitable enclosures for collecting grit and dust from the blasting operation. During abrasive blasting, surfaces intended to be left smooth, such as rustications, chamfers and tie cone holes, shall be protected from blasting by masking with wood, metal, rubber or tape. Avoid rounding edges. All inserts shall be masked and protected from blasting. Sandblasting shall comply with all local and state anti-pollution laws.
- F. Finishing Concrete Vertical Surfaces Exposed to View and not scheduled to be sandblasted: 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. Thoroughly clean surfaces 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.

- G. 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.

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 (but must be coordinated with the requirements of the selected flooring manufacturers and contractors. Requirements of the flooring manufacturer shall govern, if different):

Float Finish: Slabs to receive unbonded toppings, steel trowel finish, mortar setting beds, equipment pads, and other similar surfaces 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.

Light Steel Trowel Finish: At areas to receive resilient floor covering, carpeting, or other floor covering, perform a light steel troweling immediately after floating. These areas shall be prepared in accordance with ASTM F 710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

Steel Trowel Finish: At floors to remain exposed to view, 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 burnished finish.

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 (no troweling). 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.

Broom Finish: Provide edged and jointed broom finish for exposed concrete pavements, ramps, stairs, and other similar surfaces. Slab surfaces shall be float finished following the procedures listed below. Following the float finish, 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 to obtain a distinct edge. Match texture approved by Architect from sample panel.

- B. Concrete for formed floor slabs shall be poured to the proper elevations by adding concrete and/or by adjusting formwork supports to compensate for form and shoring deflections. Positive means of adjustment (wedges and jacks) of shores and struts shall be provided and all settlement shall be taken up during concrete placing operation. Slab thickness indicated on drawings is a minimum.
- C. Concrete for floor slabs on metal deck and metal forms 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.
- D. 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

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 specified 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.

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

- F. Concrete slab surfaces to be sloped shall be sloped uniformly to drains.
- G. Concrete slabs to receive Portland cement setting beds or concrete or fills shall be given a rough wood float or broom finish.
- H. 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 to obtain a distinct edge.
- I. No dry cement or mixture of sand and cement shall be applied to surface of any concrete slab to absorb moisture.
- J. Protect floors from damage until completion of job. Floors to remain exposed or be polished shall be protected with masonite or plywood to prevent staining and mechanical damage to slabs. No permanent marks (such as paint, marker, and/or pencil) shall be applied to those concrete floors to be polished, before or after polishing work has been done. No marks shall be made that will be exposed to view in the finished work.

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. Surveys shall be taken prior to removal of shoring, as applicable.
- C. 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 Paragraphs 2.1 H and 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, and/or other debris 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 specified 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 or concrete curing covers.

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 48 hours, 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 MASTIC COATING OF EMBEDDED STRUCTURAL STEEL

- A. Install mastic coating continuously over steel embedded in concrete or soil in accordance with the manufacturer's recommendations.

3.16 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.

3.17 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.

3.18 NON-SHRINK GROUT

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

3.19 ANCHOR ROD BASE PLATE HOLE GROUT

- A. Grout solid all oversize brace column steel base plate holes around anchor rods in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 03 30 60

SITE ARCHITECTURAL 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 SUMMARY

- A. The Work of this Section includes, but is not limited to, the following:
 - 1. Cast-in-Place Retaining Walls
 - 2. Cast-in Place Stairs

1.3 RELATED WORK

- A. Related work includes, but is not limited to, the following work covered in other sections:
 - 1. SECTION 03 30 00 – EARTHWORK
 - 2. SECTION 12 93 00 – SITE FURNISHINGS
 - 3. SECTION 32 13 16 – INTEGRALLY COLORED CONCRETE PAVING
 - 4. SECTION 03 30 55 – CAST-IN-PLACE CONCRETE (SITE)

1.4 REFERENCES

- A. Comply with applicable requirements of:
 - 1. State of New Hampshire, Standard Specification for Roads and Bridge Construction, Department of Transportation, latest edition.
 - 2. City of Dover, of the State of New Hampshire, and of other authorities having jurisdiction. Provide labor, materials, equipment and services to comply with requirements.
 - 3. ASTM: American Society of Testing Materials.
 - 4. AASHTO: American Association of State Highway and Transportation Officials.
 - 5. ACI: American Concrete Institute

1.5 ARCHITECTURAL CONCRETE

- A. Architectural concrete systems are required for portions of the work and will be subject to placing, forming, finishing and placement requirements as set forth in ACI 301, Chapter 13 and ancillary references thereto. Final finish to be determined during the mockup process.

1.6 SUBMITTALS

- A. Submittals: in accordance with SECTION 01 30 00 – SUBMITTAL REQUIREMENTS.
- B. Product Data: submit manufacturer's specifications and installation instructions for:
 - 1. Preformed Joint Filler
 - 2. Silicon Sealant
 - 3. Backer Rod
 - 4. Form Liner
- C. Shop Drawings: Submit shop drawings for the following components showing attachment methods, fabrication, casting and hardware:
 - 1. Site Architectural Concrete Components
 - 2. Concrete Components
- D. Samples: submit:
 - 1. Sandblast Texture finish samples:
 - a. Sandblast Finish – Provide three 12" samples to exhibit a medium and light sand blast finish for review and selection by the Owner's Representative.
 - 2. Form liner Texture finish samples:
 - a. Form Liner Finish – Provide three 12" square samples that exhibit the specified form liner pattern for review and approval by Owner's Representative.
 - 3. Material samples for selection by Owner's Representative of the following:
 - a. Aggregate - 1 pint
- E. Mockups
 - 1. Full Size Sample Mockups: Provide full size sample mockups for review and approval by Owner's Representative prior to providing remaining walls and steps.
 - a. Sample Mockups will be maintained throughout the project as representative of the approved finish and appearance to be expected in the completed components. Mockup samples to include form ties, chamfers, reveals, and jointing of wall. If approved, these submittals may become part of the final work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Formwork: as specified in SECTION 03 30 55 – CAST-IN-PLACE CONCRETE (Site) and modified as follows:
 - 1. Locate joints in formwork for site architectural concrete indicated on the Drawings.

2. Formwork for architectural concrete must be of the highest quality to obtain smooth, straight, non-yielding surfaces. Form lumber should be of a resin overlay type or have a polyurethane or similar coating sufficiently heavy to prevent transfer of wood grain and to fill and cover boats (plugs) in plywood. All wood form joints must be cleaned of release agent residue and then sealed with a 2" wide vinyl or polyester film type to prevent leakage of mix water. A silicone sealant may be used for joint sealing. Plastic snap-tie cones should be of the non-leakage type.
 - B. Form Ties: integrally-colored fiberglass flush form ties, with color to match pigmented aggregate in this concrete. Provide form ties for construction of architectural concrete mock-up specified in SECTION 03 30 55 – CAST-IN-PLACE CONCRETE (Site) for approval of color and appearance. Review and inspect tie locations with Owner's Representative before placement of concrete. After removal of forms for architectural concrete, cut tie flush with surface of concrete prior to sandblasting. Grind tie flush with adjacent surfaces after sandblasting to conceal appearance.
 - C. Aggregate: Provide aggregate as specified in SECTION 03 30 55 CAST-IN-PLACE CONCRETE (Site).
 - D. Preformed Joint Filler: Sponge rubber in conformance to AASHTO M-153-65, Type I, Fed. Spec. HH-F- 341 F, Type II, Class A and ASTM D-1752-67, Type I and be one of the following:
 1. Sealtight Sponge Rubber Expansion Joint Filler, manufactured by W.R. Meadows, Inc., Elgin, IL.
 2. Or Equal.
 - E. Silicon Sealant: Sikaflex – 2c NS with Sikaflex 429 primer, two part non-sagging, polyurethane elastomeric sealant complying with Fed. Spec. TT-S-00227E Type 2 Class A and ASTM C920, Type M, Grade NS, Class 25, Use NT, T, M, G, A and O.
 1. Where joint surfaces contain bituminous materials, provide modified sealant compatible with bituminous materials encountered.
 2. Color: to be selected by Landscape Architect.
 - F. Backer Rod: A continuous round rod of 100% closed cell polyethylene foam, complying with requirements of ASTM C-272.
- 2.2 FORM LINER
- A. Form Liner: as manufactured by Symons by Dayton Superior, 1155 Church Hill Drive, New Braunfels, TX 78130, Phone: (210) 648-6100.
 1. Finish style: TBD.
 - a. Form liner finish – refer to Paragraph 3.01, C.1 for limits of form liner finish.
 2. Application methods as directed by Manufacturer.

PART 3 - EXECUTION

3.1 CONCRETE FINISH DESIGNATIONS AND PROCEDURES

- A. As a minimum, the vertical surfaces must be sandblasted sufficiently to remove minor form marks and colored residue resulting from water and cement migrating (bleeding) toward the forms during concrete placement and compaction.
- B. Finishes:
 - 1. Smooth form finish: exposed concrete, including stainless steel snap ties with cones and removing vertical fins and other objectionable form marks. Coordinate location of ties with placement of formed reveals to ensure ties are not located in reveal areas. Review and inspect tie locations with Owner's Representative before placement of concrete.
 - 2. Textured finish: Abrasive sandblast finish, using abrasive grit, equipment, application and cleaning procedures to expose aggregate and surrounding matrix to a level approved by the Owner's Representative. Expose and reveal coarse aggregate to maximum projection of one third of the diameter, reveal 1/4 to 1/2 inch. Surface shall be rugged and consistent, as demonstrated by finish objective samples and as achieved in approved full sized sample mock-ups.
- C. Finish Schedule for Site Architectural Concrete:
 - 1. Form Liner Finish:
 - a.
 - 1. All exposed vertical surfaces to 2" below finish grade.
 - 2. Textured Finish:
 - a. TBD.
 - 1. All vertical and horizontal surfaces to 2" below finish grade.
- D. Patching:
 - 1. The combined total of patched areas in architectural concrete surfaces shall not exceed 2 sq. ft. in each 1000 sq. ft. of the surface.
 - 2. Prior to proceeding with any patch work, the contractor is responsible for establishing trial patch areas to develop the approved patching color and the method of applying and surface-texturing the patching material.
 - 3. For patching snap-tie holes, rock pockets, and other major imperfections, colored patching. Mix in the proper color, preferably made with the job brand and type of cement, should be field-blended in various portions (to determine the proper mixture) with patching mix, White, made with either fine or coarse sand, and test patches made, textured, and compared for color and texture result. In most instances, concrete should be patched after texturing; however, the actual job technique should be developed on the test panel and modified as required on the job to produce optimum results.

END OF SECTION

SECTION 033300

ARCHITECTURAL 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. Cooperate 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 complete the work of this Section, including but not limited to the following:
 - 1. Cast-in-place architectural concrete including form facings, reinforcement accessories, concrete materials, concrete mixture design, placement procedures, and finishes.
 - 2. The requirements of this Section complement Section 033000, CAST-IN-PLACE CONCRETE; and apply to architectural concrete as specified and as indicated on Drawings.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control.
 - 2. Section 079200 - JOINT SEALANTS for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.

1.3 DEFINITIONS

- A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.
- B. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.
- C. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

- D. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Description of Methods and Sequence of Placement. For each type of specially-finished concrete provide description of methods and sequence of placement.
- C. Certificates: Prior to installation submit copies of a signed affidavit from the manufacturer of the coloring product stating that coloring product to be used in concrete is compatible with the concrete mix and type to which it will be combined, and that no adverse affects will occur to the workability, setting, or strength of concrete.
- D. Manufacturer's Review: Submit written signed statement, that Contract Documents have been reviewed by qualified representatives of the materials manufacturer, and that materials and system to be used for floor finish are proper and adequate for the applications shown.
- E. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for all products in concrete floor finish, including certifications and other data as may be required to show compliance with the Contract Documents.
- F. Substrate Acceptability: Submit a certified statement issued by the manufacturer of concrete floor finish materials and countersigned by installer, attesting that surfaces designated to receive concrete floor finish are satisfactory warranty requirements. Application of materials will be construed as acceptance of surfaces.
- G. Statement of Supervision: Submit signed statement signed that field supervision by manufacturer's representative was sufficient to ensure proper application of materials and that the installation is acceptable to manufacturer.
- H. Samples for Verification: Architectural concrete samples, cast vertically, approximately 18 by 18 by 2 inches, of finishes, colors, and textures to match design reference sample. Include Sample sets showing the full range of variations expected in these characteristics.

1.5 QUALITY ASSURANCE

- A. Finish Objective Samples. If samples are placed on display in the office of the Architect, to describe finish objectives, such samples are hereby made part of these Specifications to the degree that the samples exhibit the required color, texture and surface finish requirements. Such samples, if provided, are provided for bidding purposes only; the actual mix components, forming, placing, and finishing procedures and requirements shall be as determined by acceptable preconstruction mock-ups.
- B. Preconstruction Conference. Attend a preconstruction conference prior to the start of architectural concrete construction as directed by the Architect. Discussion will include the following:
 - 1. The Contractor's program to obtain the specified quality of architectural concrete.

2. The procedures and methods for construction of preconstruction mock-ups specified herein.

C. Preconstruction Mock-up Panels or Areas:

1. General:
 - a. Schedule mock-up casting for acceptance 30 days prior to casting of architectural concrete surfaces represented by the mock-ups.
 - b. Locate mock-up panels in non-public areas acceptable to the Architect. Brace panels as required for safety.
 - c. Continue to cast mock-ups until acceptable mock-ups are produced. Accepted mock-ups shall be the standard for color, texture, and workmanship for the work.
 - d. Mock-up sequence of forming, placing, form removal, curing and finishing shall be reviewed and accepted by the Architect.
 - e. Mock-up formwork shall be inspected and accepted by the Architect before placing of concrete.
 - f. Use the same concrete mixes and placement procedures, accepted in mock-ups, in the final work, unless otherwise directed by the Architect.
 - g. Protect accepted mock-ups from damage until completion and acceptance of the work represented by the mock-up.
 - h. Remove mock-up panels from site at completion of Project, as directed by the Architect.
2. Construct mock-up panels or areas as indicated to demonstrate the ability to cast architectural concrete to achieve shapes, color, and textured finishes required. Mock-ups shall include or meet the following requirements:
 - a. Provide full scale mock-up panels and areas.
 - b. Provide mock-ups simulating actual design and execution conditions for concrete mix materials, reinforcement, formwork, placing sequence, form removal, curing, finishing, and methods and materials of stain removal and correction of defective work.
 - c. On mock-ups where directed by the Architect, provide minimum of five variation of mix color to be used in the repair of defective work, in order to determine acceptable color and texture match.
 - d. Demonstrate, on the mock-ups, materials and methods of plugging tie-holes unless tie holes are indicated to be left in place.
 - e. Demonstrate in the construction of the mock-up formwork the sealer material, form release agent, and curing materials and methods to be used.

- D. Source of Materials. Utilize the same source, stock or brand of concrete materials for each class or mix of architectural concrete. Do not interchange materials or mixes until an additional mock-up shows that uniformity in finish, texture, and color, as compared to original mock-up will be maintained. If necessary, obtain and stockpile materials in sufficient quantity to ensure continuity and uniformity.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened containers identified with brand, type, grade, date of manufacture, class, lot number, and other qualifying information.
- B. Store materials in original sealed containers, in dry enclosed storage area, within temperature range recommended by manufacturer.

1.7 JOB CONDITIONS

- A. Maintain manufacturer's current installation instructions at Project site.
- B. Maintain interior building area above 50oF before, during, and after installation of architectural concrete until structure and subfloor temperatures are stabilized.
- C. Provide and maintain adequate ventilation until concrete cures completely.

1.8 PROTECTION

- A. Protect adjacent surfaces and repair, restore, or replace soiled or damaged in performance of special architectural concrete finish work.

1.9 GUARANTEE

- A. Warrant work of this Section for five years from date of Substantial Completion; correct defects upon written notice at no additional cost to Owner. Warranty shall be signed by installer and materials manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Except as otherwise indicated, concrete materials including aggregates, Portland cement, and water shall conform to Section 033000, CAST-IN-PLACE CONCRETE.

2.2 ARCHITECTURAL CONCRETE FOR VERTICAL WALLS

- A. Concrete: Color of concrete shall be normalweight concrete without color additive; color for architectural concrete shall be uniform throughout area designated.
- B. Formwork Ties: Formwork tie spacing and location of ties shall be in a consistent pattern or layout acceptable to the Architect. Tie design shall be acceptable to the Architect.
- C. Formwork Materials: Steel faced, High Density Overlay plyform as described in Section 033000, or fiberglass faced formwork as required to produce a smooth form finish acceptable to the Architect.

1. Architectural Concrete Finish No. 1 - Smooth Form Finish with Smooth Rubbed Finish:

- a. Formwork: Smooth form concrete using steel forms, High Density Overlay plyform as described in Section 033000, or fiberglass forms. Joints in formwork shall be sealed. Form ties shall be uniformly placed accurately located in accordance with layout approved by the Architect.
- b. Finish Description/Procedure: Rubbing shall be produced on newly hardened concrete no later than the day following form removal. When required by the Architect to correct work done in an incorrect manner or in a manner not as specified, rubbing shall commence within 48 hours of notification by the Architect. Surfaces to be rubbed shall be wetted and rubbed with carborundum brick or other approved abrasive of equal quality until uniform

- color and texture are produced, without applying any cement, grout or other coating. Rubbing will not be permitted when the air temperature is expected to fall below 40 degrees F. Rubbing may be performed by use of approved power equipment and tools, providing that the operational procedures shall produce the same desired effects as hand rubbing.
- c. Cement Color: Color meeting approved mock-up. In order to achieve the desired color/finish of concrete, concrete mix may required the use of a white cement or control of color of aggregates may be required.
- 2. Architectural Concrete Finish No. 3 – Smooth, Steel Troweled Finish Concrete Slab with Concrete Sealer.
 - a. Finish Description/Procedure: Smooth, steel troweled concrete finish (Architectural Finish) with concrete sealer. It is intended that this floor finish be a very high quality cast-in-place concrete finish with smooth steel troweled finish and a special concrete sealer to achieve the acceptable appearance.

PART 3 - EXECUTION

3.1 PLACING CONCRETE

- A. Except as modified herein, concrete shall be placed in accordance with Section 033000, CAST-IN-PLACE CONCRETE.
 - 1. Consolidate vertical colored concrete in lifts 1 ft. or less in depth and vibrate twice that normally required by decreasing the spacing, depth, and time to ensure uniform color.
 - 2. There shall be no honeycombing or segregated aggregates in concrete exposed to view in areas identified as Architectural Concrete.

3.2 PROTECTION FROM AND REMOVAL OF STAINS

- A. On mock-up where directed by the Architect, demonstrate methods of rust stain removal in accordance with recommendations of ACI 303 Chapter 10, Section 10.4.
- B. Comply with requirements of Section 033000, CAST-IN-PLACE CONCRETE, and procedures used in construction of accepted mock-ups.

END OF SECTION

SECTION 033650
CONCRETE FINISHES

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. Section Includes:
 - 1. Dye stain for stained concrete.
 - 2. Densifier applied to concrete.
 - 3. Curing compound for concrete.
 - 4. Grinding and polishing concrete.
 - 5. Sealing concrete surfaces.
- B. Related Sections:
 - 1. Division 3 Section "Cast-In-Place Concrete" for general requirements of concrete.
 - 2. Division 7 Section "Joint Sealants" for colored sealants for joints.

1.3 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. ACI 301 "Specification for Structural Concrete for Buildings."
 - 2. ACI 302 IR "Recommended Practice for Concrete Floor and Slab Construction."
 - 3. ACI 303.1 "Standard Specification for Cast-In-Place Architectural Concrete."
 - 4. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing of Concrete."
 - 5. ACI 305R "Recommended Practice for Hot Weather Concreting."
 - 6. ACI 306R "Recommended Practice for Cold Weather Concreting."
- B. American Society of Testing and Materials (ASTM):

1. ASTM C309 "Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete."
2. ASTM C494 "Standard Specification for Chemical Admixtures for Concrete."

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's complete technical data sheets for the following:
 1. Concrete dye stain.
 2. Colored admixture.
 3. Curing compound.
 4. Densifier.
 5. Sealing finish coats.
- B. Design Mixes: For each type of concrete.
- C. Samples for Initial Selection:
 1. Colors: Manufacturer's color charts showing full range of colors available.
- D. Samples for Verification (after color selections):
 1. Polished Finish: Provide (2) 6 inch x 6 inch concrete samples for each polished concrete finish required.
- E. Qualification Data: For firms indicated in "Quality Assurance" Article, including list of completed projects.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with 10-years experience in manufacture of specified products.
- B. Installer Qualifications: Contractor to have experience in doing 5 similar sized projects. These projects to be submitted for approval.
- C. Comply with the requirements of ACI 301. Coordinate with cast-in-place concrete installer to ensure that areas to receive polished stained concrete finish have a floor flatness meeting or exceeding 35.
- D. Obtain each specified material from same source and maintain high degree of consistency in workmanship throughout Project.
- E. Notification of manufacturer's authorized representative shall be given at least 1-week before start of Work.

- F. Provide project names, addresses, contact names, phone numbers of at least three (3) projects of similar scope completed by the installer.
- G. Installer/Applicator shall be certified by concrete finish equipment and chemical manufacturer and shall provide adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
- H. Manufacturer's Certification: Provide a letter of certification from both the equipment and chemical manufacturer stating that the installer is a certified applicator and is familiar with proper procedures and installation requirements recommended by the manufacturer.
- I. Colored Concrete Mockup:
 - 1. Mock up meeting to be held one week prior to mock ups being placed. It is suggested that Architect, General Contractor, Construction Manager, Polishing Subcontractor, Concrete Finishing Contractor, Chemical Representative, and Dye Representative be present.
 - 2. At location on Project selected by Architect place and finish a 10 feet x 10 feet sample area for each dye stained sample. Mockup placements shall be completed 30 days prior to pre-job conference
 - 3. Construct mockups using processes and techniques intended for use on permanent work, including curing procedures. Include samples of control, construction, and expansion joints in sample panels. Mockup shall be produced by the individual workers who will perform the work for the Project.
 - 4. Sample material of Densifier and Acetone Dye for the mock ups shall be provided by the chemical manufacturer at no cost to the Owner.
 - 5. Accepted mockups provide visual standard for work of Section.
 - 6. Mockups shall remain through completion of the work for use as a quality standard for finished work.
 - 7. Remove mockups at the end of the project after the Architects approval of all finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in original factory unopened, undamaged packaging bearing identification of product, manufacturer, batch number, and expiration data, as applicable.
- B. Store the product in a location protected from damage, construction activity, and precipitation in strict accordance with the manufacturer's recommendations.

1.7 PROJECT CONDITIONS

- A. Schedule placements to minimize exposure to wind and hot sun before curing materials are applied.
- B. Avoid placing concrete if rain, snow, or frost is forecast within 24-hours. Protect fresh concrete from moisture and freezing.
- C. Comply with professional practices described in ACI 305R and ACI 306R.

1.8 PRE-JOB CONFERENCE

- A. Three weeks prior to placement of concrete, a meeting shall be held to discuss the Project and application methods.
- B. The Architect, General Contractor, Construction Manager, Subcontractor, Polishing Subcontractor, Concrete Finishing Contractor, Chemical Representative, and Dye Representative shall be present.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. L. M. Scofield Co.
 - 2. QC Construction Products.
 - 3. Rockwood Pigments/Elements.
 - 4. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by the L. M. Scofield Co. to establish the general character and materials required for materials for this project. Equivalent products by acceptable manufacturers will be approved.

2.2 MATERIALS

- A. Curing Compound for Concrete:
 - 1. LITHOCHROME COLORWAX by L.M. SCOFIELD COMPANY, or approved equal. Use to cure in the same color as the concrete directly after finishing process.
 - a. ASTM C309.
- B. Solvent based color dye to penetrate concrete surface:
 - 1. Formula One Liquid Dye Concentrate by L.M. SCOFIELD COMPANY, or approved equal.
- C. Concrete Sealer/Finish Coat:
 - 1. Formula One Guard-S Concentrate by L.M. SCOFIELD COMPANY, or approved equal.
- D. Chemical Hardener/Densifiers:
 - 1. Formula One - LD by L.M. SCOFIELD COMPANY, or approved equal. Provide a high performing hardening and dust proofing compound that is chemically reactive and permanently bonds to concrete formulated to be used in conjunction with integrally colored concrete as well as uncolored concrete.

E. Grinding and Polishing Equipment:

1. 3-head or 4-head counter rotating variable speed floor grinding machine with at least 600 pounds down pressure.
2. Dust extraction system, pre-separator, and squeegee attachments with minimum flow rating of 322 cubic feet per minute.
3. Grinding heads:
 - a. Metal bonded 16, 25, 40, 60, 80, 150 and 300 grits.
 - b. Resin bonded, phenolic diamonds, 100, 200, 400, 800, 1500 and 3000 grits.
4. Grinding pads for edges:
 - a. 40, 60, 100, 120, 200, 400, 800, 1500 and 3000 grits.
5. Hand grinder with dust extraction equipment and pads.

2.3 COLORS

- A. Colors: As selected by Architect from manufacturer's full range for each type of product specified.
1. Color quantity for stained concrete: Up to 5 colors for each area. Refer to Architectural drawings.

2.4 CONCRETE MIX DESIGN

- A. Provide concrete in accordance with section 033000 Cast-In-Place Concrete and the following requirements:
1. Minimum Cement Content: 5 sacks per cubic yard of concrete.
 2. Slump of concrete shall be consistent throughout Project at 4-inches or less. At no time shall slump exceed 5-inches.
 3. Do not add calcium chloride to mix as it causes mottling and surface discoloration.
 4. Supplemental admixtures shall not be used unless approved by manufacturer.
 5. Do not add water to the mix in the field.
 6. Maximum air content shall not exceed 5 percent.

2.5 SCHEDULE OF CONCRETE FLOOR FINISHES

- A. Provide the following finish systems in accordance with the requirements of this Section, in locations shown on the Drawings:
1. Concrete Finish System #1 (CFS-1): Polished stained concrete finish system.
 - a. Curing compound.
 - b. Dye Stain.
 - c. Densifier.
 - d. Finish coats (VOC Exempt Solvent Based Stain Guard).

2.6 FLOOR PROTECTION

- A. Provide a multi-ply textured membrane laminated with a nonwoven polypropylene geotextile equal to Proguard Dura Cover as manufactured by Proguard, Inc.; or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

- A. Install concrete according to requirements of Division 3 Section "Cast-In-Place Concrete."
 - 1. Floor Flatness: Meet or exceed 35.
- B. Do not add water to concrete mix in the field.
- C. Applicator shall be qualified by the product manufacturer in accordance with Quality Assurance article in Part 1 herein above.
- D. Surfaces shall be finished uniformly with the following finish:
 - 1. Ground and Polished Concrete Surface (#1): Precautions should be taken to insure the surface is in tolerances to perform this function.

3.2 POLISHED CONCRETE APPLICATION

- A. Applicator shall examine the areas and conditions under which work of this section will be provided and the General Contractor shall correct conditions detrimental to the timely and proper completion of the work and the Applicator shall not proceed until unsatisfactory conditions are resolved.
- B. Grind the concrete floor to within 2 – 3 inches of walls with 16, 25, 40, 60, 80 and/or 150 grit removing construction debris, floor slab imperfections and until there is a uniform scratch pattern and desired concrete aggregate exposure.
- C. Apply material approved by architect for color effects in accordance with the architectural drawings and the manufacturer's recommended guidelines.
- D. Control joints and decorative joints shall be saw cut with new blades to prevent rough joints.
- E. Fill construction joints and cracks with silicone joint filler in accordance with manufacturer's instructions colored to match (or contrast) with concrete color as selected by architect. Fill all joints prior to polishing.
- F. Apply densifier at approximately 300 square feet per gallon, in certain instances densifier may be diluted 1:1 with clean potable water. Cover the entire area liberally. Using a broom, work the densifier into the substrate for 30 minutes. During this 30-minute period, continually keep the substrate wet with densifier. Squeegee excess material off the floor,

after removing excess wash floor with clean potable water. Allow 30-40 minutes for concrete surface to dry prior to continuation of polishing.

- G. Grind the floor to within 2 – 3 inches of walls with metal bonded diamond grits of 150 and 300—grinding 90o from each previous grind and removing all the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- H. Grind the edges with 40, 60, 120 and 220 grit grinding pads removing all of the scratches from the previous grit. Vacuum the floor thoroughly after each grind using a squeegee vacuum attachment.
- I. Polish the floor, to desired sheen level, with phenolic resin bonded diamond grits of 100, 400, 800, 1500 and 3000—first polishing the edges with pads of the same grit and then the field of the floor removing all scratches from the previous grit. After each polish, clean the floor thoroughly using clean water and an auto scrubber or a mop and a wet vacuum.
- J. Stained Concrete: Apply dye to surface between 200 – 400 grit. Allow dye to dry to touch.
- K. Apply densifier at a rate of 300 square feet per gallon. Using a broom, work the material into the floor for a minimum of 20 - 30 minutes. Tight squeegee the remaining material from the floor without leaving squeegee marks or puddles. Allow to cure for 12 – 24 hours.
- L. Polish up to 1,500-resin bond grind.
- M. Apply finish coat at 300 square feet per gallon.
- N. Immediately prior to substantial completion, using a high speed (5000 rpm) burnishing machine and hogs hair burnishing pad, or diamond impregnated pad (400, 800. or 1500 grit), buff the surface to a high shine.
- O. Upon completion, the work shall be ready for final inspection and acceptance by the customer.

3.3 CURING

- A. Concrete: Apply curing and sealing compound for concrete according to manufacturer's instructions using manufacturer's recommended application techniques. Apply curing and sealing compound at consistent time for each pour to maintain close color consistency.
- B. Curing compound shall be same color as the colored concrete and supplied by same manufacturer of the dye and densifier.
- C. Precautions shall be taken in hot weather to prevent plastic cracking resulting from excessively rapid drying at surface as described in CIP 5 Plastic Shrinkage Cracking published by the National Ready Mixed Concrete Association.
- D. Do not cover concrete with plastic sheeting.

3.4 CUT AND SHINE LEVELS

- A. Cut Level (Depth of cut).
 - 1. Grade 2 – light exposure of course aggregate.
- B. Shine Level.
 - 1. Class 3 – 1,500 grit polish, high reflectivity. Gloss reading shall be approximately 72.
- C. Polished concrete finish coat.
 - 1. Apply two applications of finish coat, or approved equal.
- D. The final polish shall deliver a Gloss Reading of approximately 72. All Gloss readings to be assessed by an independent concrete testing laboratory for approval by the owner.
- E. Final Finish- Grade II Class III.

3.5 CLEANING

- A. The work area shall be kept clean and free of debris at all times.
- B. Remove slurry and dust from adjoining surfaces as necessary.
- C. Dispose of material containers in accordance with local regulations.
- D. Protect finished work until fully cured per manufacturer's recommendations.

3.6 PROTECTION OF FINISHED WORK

- A. Install floor protection immediately after the floor finishing with the initial polishing is complete.
- B. Prohibit foot or vehicular traffic on floor surface.
- C. Barricade area to protect flooring.
- D. Protect floor surface from damage until final inspection and acceptance by Owner.

END OF SECTION

SECTION 034500

PRECAST ARCHITECTURAL 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. Cooperate 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 complete the work of this Section, including but not limited to the following:
 - 1. Architectural precast concrete date stone, sills, and other indicated units.
- B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 042000 – UNIT MASONRY, pre-cast concrete items.
- C. Related Sections include the following:
 - 1. Section 042000 – UNIT MASONRY, for installation requirements of pre-cast concrete items.
 - 2. Section 042000 – UNIT MASONRY, for unit masonry, mortar, and anchorages.
 - 3. Section 079200 – JOINT SEALANTS, for elastomeric joint sealants and sealant backings.
 - 4. Section 076200 – SHEET METAL FLASHING AND TRIM, for flashing receivers and reglets.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast architectural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Wind Loads: As indicated on Structural Drawings.
 - 2. Earthquake Loads: As indicated on Structural Drawings.
 - 3. Thermal Movements: Provide for in-plane thermal movements resulting from annual

ambient temperature changes of 120 deg F (67 deg C)

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixes: For each concrete mix.
- C. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement.
 - 1. Indicate separate face and backup mix locations and thicknesses.
 - 2. Indicate locations and extent and treatment of dry joints if two-stage casting is proposed.
 - 3. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware, inserts, connections, and joints, including accessories.
 - 4. Indicate locations and details of anchorage devices to be embedded in other construction.
 - 5. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation. Provide P.E. stamped shop drawings and P.E. stamped calculations for all members and all connections and supports.
- D. Samples for Initial Selection: For the following:
 - 1. Precast concrete, in the form of 3-inch (76 mm) square samples showing full range of colors and finishes available.
- E. Samples for Verification: For each type and color of the following:
 - 1. Precast concrete: One, 12 by 12 by 2 inch sample, in color and finish selected.
- F. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- G. Material Test Reports: For aggregates.
- H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - 1. Concrete materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 4. Water-absorption test reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed precast architectural concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast architectural concrete units similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 2. 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 or in APA's Plant Certification Program for Production of Architectural Precast Concrete Products and is designated an APA-certified plant.
 - 3. Has sufficient production capacity to produce required units without delaying the Work.
 - 4. Is registered with and approved by authorities having jurisdiction.
 - C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated.
 - D. Design Standards: Comply with ACI 318 and the design recommendations of PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."
 - 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. Product Options: Drawings indicate size, profiles, and dimensional requirements of precast concrete units and are based on the specific types of units indicated. Other fabricators' precast concrete units complying with requirements may be considered. Refer to Division 1 Section "Substitutions."
 - G. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 - H. Mockups: Before installing precast architectural concrete units, furnish pre-cast concrete products for exterior wall sample mock-up panels. Refer to Section 042000 – UNIT MASONRY for scope of mockups.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver precast architectural concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.
 - B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.
- 1.7 SEQUENCING
- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required,

for installation.

PART 2 - PRODUCTS

2.1 MOLD MATERIALS

- A. Molds: Provide molds and, where required, form-facing materials of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes
- B. Form Liners: Units of face design, texture, arrangement, and configuration indicated.

2.2 REINFORCING MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent. Galvanized Reinforcing Bars: ASTM A 767/A 767M, Class II zinc coated, hot-dip galvanized after fabrication and bending, as follows:
 - 1. Steel Reinforcement: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I or Type III, white, of same type, brand, and source.
 - 1. Standard gray portland cement may be used for nonexposed backup concrete.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S.
 - 1. Color of Face-Mix Aggregate: White or Grey to produce selected color.
 - 2. Face-Mix Coarse Aggregates: Selected, hard, and durable pea gravel; free of material that reacts with cement or causes staining.

- a. Gradation:

Sieve:	Retained % by Weight
1/2-inch	0
3/8-inch	0-10
#4	40-70
#8	90-95

- b. Fineness Modulus: 2.80 (0.20)
 - c. Organic: Plate 2 maximum
 - d. Silt: 2.0% maximum
 - e. Mortar Strength: 100% minimum compression ratio
 - f. Soundness: 5% maximum loss, magnesium sulfate, 5 cycles (ASTM C-88)
 - 3. Face-Mix Fine Aggregates: Selected, natural or manufactured sand of the same material as coarse aggregate, unless otherwise approved by Architect.

- a. Gradation:

Sieve:	Retained % by Weight

Sieve:	Retained % by Weight
#4	0-5
#8	10-20
#16	25-40
#30	40-70
#50	75-85
#100	92-95

- b. Fineness Modulus: 2.80 (0.20)
 - c. Organic: Plate 2 maximum
 - d. Silt: 2.0% maximum
 - e. Mortar Strength: 100% minimum compression ratio
 - f. Soundness: 5% maximum loss, magnesium sulfate, 5 cycles (ASTM C-88)
- C. Coloring Admixture: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.
- D. 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.
- E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- F. Water-Reducing Admixture: ASTM C 494, Type A.
- G. Color of Finished Product: Provide 2 custom colors as selected by Architect.

2.4 STEEL CONNECTION MATERIALS

- A. Stainless Steel Bolts and Studs: ASTM F 593, Alloy 304 or 316 stainless steel, hex-head bolts and studs; stainless steel nuts; and flat, stainless steel washers.
1. Stainless steel pins: Each pin shall be 4" long and no less than 5/8" in diameter. Provide a minimum of 2 pins per section for embodiment into brick veneer.
- B. Accessories: Provide clips, hangers, plastic shims, and other accessories required to install precast architectural concrete units.

2.5 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. 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, of consistency suitable for application.
- C. Color: Provide 2 colors as selected by Architect.

2.6 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast architectural concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318
- D. Normal-Weight Concrete Face and Backup Mixes: Proportion mixes 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
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: 12 to 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 mixes, add other admixtures to concrete mixes according to manufacturer's written instructions.

2.7 MOLD FABRICATION

- A. Molds: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes.
 - 1. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during concreting. Coat form liner with form-release agent.
- B. Maintain molds to provide completed precast architectural concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.
 - 1. Edge and Corner Treatment: Uniformly chamfered or radiused, as shown on Drawings.
 - 2. Provide finished edges (side, bottom, top, back) of all shapes where edges will be exposed in final installation; at such areas of window and door jambs and sills; as well as top of wall copings and caps.

2.8 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.
- B. Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to

receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

- C. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.
 - 1. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.
- D. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.
- E. Place face mix 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.
- F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete. Place backup concrete to ensure bond with face mix concrete.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.
- H. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- I. Comply with ACI 305R recommendations for hot-weather concrete placement.
- J. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure.
- K. 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.
- L. Perform Quality Control measures, testing, and sampling and submit results to the Architect. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Architect.

2.9 FABRICATION TOLERANCES

- A. Fabricate precast architectural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished piece complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.10 FINISHES

- A. Finish exposed-face surfaces of precast architectural concrete units to match approved sample panels and as follows:

1. PCI and APA's "Architectural Precast Concrete--Color and Texture Selection Guide," of plate numbers indicated.
 2. Smooth-Surface Finish for Letter Recesses: Provide surfaces free of pockets, sand streaks, and honeycombs, with uniform color and texture.
 3. Light to Medium Abrasive-Blast Finish: Use abrasive grit, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces.
- B. Finish exposed surfaces of precast architectural concrete units to match approved face-surface finish. Finish unexposed surfaces of precast architectural concrete units by float finish.
- C. Provide finished edges (side, bottom, top, back) of all shapes where edges will be exposed in final installation; at such areas of window and door jambs and sills; as well as top of wall copings and caps.
- D. Sandblast or etch faces that will be in contact with mortar to create texture in order to increase the level of bond with the mortar.

2.11 SOURCE QUALITY CONTROL

- A. Owner may employ an independent testing agency to evaluate precast architectural 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 mixes as may be requested for additional testing and evaluation.
- B. Defective Work: Precast architectural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Section 042000 – Unit Masonry for installation requirements.

END OF SECTION

SECTION 042000

UNIT MASONRY

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 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. Mortar and grout.
 - 4. Reinforcing steel, masonry joint reinforcement, ties and anchors.
 - 5. Embedded flashing.
 - 6. Thermal Insulation at base flashing.
 - 7. Graffiti protection.
 - 8. Cutting and patching masonry construction as required for the work of all trades.
- B. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Key box for Fire Department, furnished under Section 104400.
 - 2. Section 034500 – PRECAST ARCHITECTURAL CONCRETE
 - a. Precast concrete items.
 - 3. Section 055000 - METAL FABRICATIONS:
 - a. Lintels, miscellaneous metal and iron sleeves, anchors, inserts, and plates to be built into masonry walls.
 - 4. Section 061000 - ROUGH CARPENTRY:
 - a. Wood nailers and blocking built into masonry.
 - 5. Section 072100 – THERMAL INSULATION:
 - a. Cavity wall insulation at masonry veneer walls.
 - 6. Section 210001 - FIRE PROTECTION:
 - a. Access doors in masonry openings.
 - 7. Section 220001 - PLUMBING:
 - a. Access doors in masonry openings.
 - 8. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING:

- a. Grilles in interior masonry walls.
 - b. Access doors in masonry openings.
 - c. Pipe and duct sleeves for placement into masonry openings.
- 9. Section 260001 - ELECTRICAL:
 - a. Access doors in masonry openings.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Section 051200 - STRUCTURAL STEEL FRAMING:
 - a. Anchor sections of adjustable masonry anchors for connecting to structural frame.
- D. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 061600 - SHEATHING for gypsum sheathing on cold-formed metal framing.
 - 2. Section 072500 - AIR BARRIERS for membrane air barrier.
 - 3. Section 071300 – FLUID APPLIED WATERPROOFING for waterproofing materials.
 - 4. Section 078440 - FIRESTOPPING 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.
 - 6. Section 079500 – EXPANSION CONTROL for building separation and seismic structural expansion joints except as specified herein to be included as part of the work of this Section 042000 – UNIT MASONRY..

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
- C. 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.
- D. Qualification Data: For testing agency.
- E. 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.
- F. 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.
- G. Cold-Weather and Hot Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.
- H. Compatibility Statement: Confirm that Through-Wall Flashing Materials specified herein are compatible, will not degrade and will maintain air and water continuity, with air barrier and waterproofing materials provided under other sections.
- 1.4 QUALITY ASSURANCE
- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 and ASTM E 329 for testing indicated.
- 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 mock-up panels as shown on the drawings and as indicated below:
 - a. One masonry wall panel including precast concrete units on back-up wall, size as indicated on drawings.
 - b. One interior decorative CMU wall panel, 4 feet wide by 8 feet high.
 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 STANDARD CONCRETE MASONRY UNITS (CMU)

- 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, General: ASTM C 90.
1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).

2. Weight Classification: Type N-1, Normal weight, unless otherwise indicated.
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions. Nominal dimensions required are shown on the Drawings, and include but are not limited to the following:
 - a. Face dimensions: 8-inches high by 16-inches long, typical.
 - b. Thicknesses: 8-inch (203 mm).
 4. Patterns and Textures:
 - a. Standard pattern, standard finish.
 5. Locations: Elevator shaft, penthouses, fire walls, and other indicated locations.
- C. Bond Beams: Provide bond beams at openings where steel beams are not indicated.
- D. Fire-rated Concrete Masonry Units: Provide units meeting Underwriters Laboratory Inc. requirements for wall construction as shown on Drawings. Modify solids content, shell thickness and web thickness as required to conform to Standard UL 618, Table 1.

2.3 ACOUSTICAL CONCRETE MASONRY UNITS (CMU)

- A. Manufacturers: Acceptable manufacturers include but are not limited to the following:
1. The Proudfoot Company, Inc.
 2. Trenwyth Industries
 3. York Building Products
- B. Sound-Absorbing Concrete Masonry Units, General: ASTM C 90.
1. Description: Cavity-slot resonator construction with internal cavities closed at the top and designed to accommodate metal septum and fibrous filler. Exposed face of block shall contain two straight, clean, flared slots. Provide straight-through cavities for units to be used in reinforced masonry walls.
 - a. Product for use at reinforced walls: The Proudfoot Company, Inc., *Soundblox Type RSC/RF*, or equal by approved manufacturer.
 2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
 3. Weight Classification: Lightweight.
 4. Acoustical Properties:
 - a. Sound Transmission: STC-52 or greater.
 - b. Noise Reduction: NRC 0.80 or greater.
 5. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions. Nominal dimensions required are shown on the Drawings, and include but are not limited to the following:
 - a. Face dimensions: 8-inches (203 mm) high by 16-inches (406 mm) long.
 - b. Thicknesses: 8-inch (203 mm).
 6. Patterns and Textures:
 - a. Running bond, standard face.
- C. Acoustical Filler:
1. Insulation: Incombustible fibrous material cut accurately to fit snugly in closed cavities of sound-absorbing block.

2. Septum: Metal septum laminated to one side of fibrous material, installed facing away from exposed face of unit.

D. Shapes:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions, as can be reasonably inferred from floor plans and elevations.
2. Provide bullnose units for outside corners, unless otherwise indicated.

2.4 BRICK

A. Manufacturer: Provide utility-sized brick as selected by Architect.

1. Manufacturers:
 - a. Belden Brick
 - b. Glen-Gery Brick
 - c. Watertown Brick
2. Basis of Design: As selected by Architect.
 - a. Color #1: TBD
 - b. Color #2: TBD
 - c. Color #3: TBD
 - d. Color #4: TBD

B. General: Provide shapes indicated on Drawings, and as follows:

1. Typical Size: 4" x 4" x 12".
2. 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.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide factory formed lip bricks fabricated from solid brick units. Refer to drawings for profiles required.

C. Bonding: As selected by Architect.

D. Patterns: Provide color patterns as indicated in the drawings.

E. Building (Common) Brick: ASTM C 62, Grade NW, MW, or SW.

1. Unit Compressive Strength: Match strength of face brick.
2. Size: Match size of face brick.
3. Application: Use where brick is indicated for concealed locations, not exposed to the weather. Face brick complying with requirements for grade, compressive strength, and size indicated for building brick may be substituted for building brick.

2.5 MASONRY LINTELS

- A. Masonry Lintels, General: Prefabricated or built-in-place masonry lintels made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

- B. Masonry Lintels for Interior Locations: Special U-shaped blocks designed for use as bond beams.
 - 1. Unit Compressive Strength: Match adjacent interior concrete masonry units.
 - 2. Weight Classification: Match adjacent interior concrete masonry units.
 - 3. Size: Manufactured to dimensions 3/8 inch less than nominal dimensions. Nominal dimensions required are the following:
 - a. Face dimensions: 16 inches (406 mm) high by 8 inches (203 mm) long.
 - b. Thickness: 8 inches (203 mm) typical, and 6 inches at Gymnasium walls at displacement units.
 - 4. Patterns and Textures: Match adjacent interior concrete masonry units.

2.6 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. General: Mortar and grout materials shall be mixed from only the components specified in this Article. Mortar cement, masonry cement, pre-blended mortar or grout, and additives other than those specified will not be accepted for use on this Project.
- C. 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.
- D. Hydrated Lime: ASTM C 207, Type S.
- E. 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. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- F. Aggregate for Mortar: ASTM C 144.
 - 1. Clean, washed aggregate consisting of natural light-colored sand.
 - 2. Grain Size:
 - a. 100% passing No. 8 sieve.
 - b. Maximum 35% passing No. 50 sieve.
 - c. Fineness modulus: 2.25 +/- 0.10.
 - 3. Obtain all sand for mortar aggregate from a single source.
 - 4. Colors: Provide up to 3 different custom colors as selected by Architect for each masonry type and color. Different mortar colors within same wall plane will be required.
- G. Aggregate for Grout: ASTM C 404.
- H. Admixtures:
 - 1. Water-Repellent Admixture: Powdered water-repellent mortar admixture intended for

use with concrete masonry units that contain integral water repellent.

- a. Products: As recommended by manufacturer of concrete masonry units that contain integral water-repellent.

2. No anti-freeze admixtures will be permitted for use in mortar or grout.

- I. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- 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 for Side Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
 4. Wire Size for Cross Rods: W2.8 or 0.188-inch (4.8-mm) diameter.
 5. Wire Size for Veneer Ties: W2.8 or 0.188-inch (4.8-mm) diameter.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
 7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods. Ladder type shall be used for vertically reinforced walls, truss type for non-vertically reinforced walls.
- D. Masonry Joint Reinforcement for Multiwythe Masonry:
 1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.
 - a. Product: Wire Bond, Series 800 Level Hook and Eye Ladder, or approved equal.
- E. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized, carbon-steel continuous wire.

2.8 TIES AND ANCHORS

- A. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with the 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 304.
 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
 4. Stainless-Steel Sheet: ASTM A 666, Type 304.
- B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires

are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

- C. 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. Connections to Steel Frame:
 - a. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.4-mm-) diameter, hot-dip galvanized steel wire.
 - b. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.188-inch- (4.8-mm-) diameter, hot-dip galvanized steel wire.
- D. Adjustable Masonry-Veneer Anchors – Thermally-Broken:
 - 1. General: Provide thermally-broken 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. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
 - a. Anchor Section: Stainless steel barrel section, polymer coated screw with hex head with plastic-encapsulated steel wing and corrosion-resistant, self-drilling screw. Wing designed to receive wire tie . 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.
 - c. Basis-of-Design: 2-Seal Thermal Wing Nut Anchor by Hohmann & Barnard or approved equal by Posi-Tie (thermally broken), or equal.
- E. Adjustable Masonry-Veneer Anchors for Connecting to CMU Backup: Rectangular adjustable wall wire ties.
 - 1. Product: Provide Hohmann & Barnard, Inc; Lox-All Adjustable eye-wire or approved equal.
 - 2. Material: Hot dipped galvanized.

2.9 MISCELLANEOUS ANCHORS

- A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.
- B. Postinstalled Anchors: Provide chemical or torque-controlled expansion anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
 - 1. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.10 EMBEDDED FLASHING MATERIALS

- A. Through-Wall Metal Flashing: Provide stainless steel type 304, 26ga, sheet in accordance with Section 076200 – Sheet Metal Flashing and Trim. Provide continuous flashing including preformed outside, inside corners, and end dams with smooth uninterrupted soldered seams and hemmed edges to maintain continuity. Custom sizes will be required see drawings for profiles required.
 - 1. Product: Stainless Steel Metal Flashing Corners & End Dams by Hohmann & Barnard, Inc., or approved equal.
- 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. Transition Strips: Provide long-term compatible 6" wide transition strips to seal embedded flashing terminations to air barrier membrane. Comply with requirements of section 072500 – AIR BARRIERS.
- E. Drip Edge: Provide type 304 stainless steel drip edge plates, 26 ga, 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.
 - 1. Product: DP-FTSA, DP-FTSA-LB, Drip Plate Corners as manufactured by Hohmann & Barnard, Inc., or approved equal.
- F. Drip Edge at Roof to Wall Sheet Metal Counter Flashing Interface: Provide titanium zinc alloy drip edge in accordance with Section 076200- Sheet Metal Flashing & Trim. Provide preformed outside and inside corner drip plate corners with smooth uninterrupted soldered seams and hemmed drip edges to maintain continuity. Custom profiles and sizes will be required; see drawings for profiles required.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Expansion Joint Filler: Precompressed foam strip manufactured to serve as filler and seal for expansion and seismic joints in exterior masonry, with the following properties:
 - 1. Product: Emseal Joint Systems, Ltd., *Seismic Colorseal*, or equal by approved manufacturer.
 - 2. Materials:
 - a. Foam Filler: Open-cell polyurethane foam, impregnated with water-based, stabilized synthetic resin, cured prior to precompression.
 - b. Facing: Factory-applied silicone facing material available in at least 10 colors. Architect shall select up to 2 different colors.
 - 3. Dimensions:
 - a. Exterior Seal: As required to seal joint designed to be 4-inches (102 mm) wide, un-

less otherwise indicated, and verified in field.

4. Performance Criteria:
 - a. Capable of accommodating lateral movements up to plus or minus 50 percent.
 - b. Durometer hardness of facing: Shore A, 15 pts, per ASTM D2240.
 - c. Staining: None.
 - d. Weathering:
 - 1) No visible deterioration after testing for 2,000 hours with a Xenon Arc Weatherometer, per ASTM G26-77.
 - 2) Minimal hardness change after testing for 6,000 hours with an Atlas Weatherometer, per ASTM G26-77
 - e. Temperature range:
 - 1) High Permanent: 185° F (85° C), per ASTM C711
 - 2) Low Permanent: -40° F (-40° C), per ASTM C711
 - f. Tensile strength: Minimum 21 p.s.i. (145 kPa), per ASTM D3574
 - g. Thermal conductivity: 0.34 BTU.inch/hr ft² °F (0.05 W/m. °C), per ASTM C518.
5. Accessory Materials:
 - a. Silicone sealant: One-part, low-modulus, non-sagging, neutral-curing silicone sealant with Shore A hardness of 15, meeting ASTM C0920, Type S, Grade NS, Class 25, Use NT.
- B. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from closed-cell polyurethane or neoprene.
- C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- D. Weep/Vent: Subject to compliance with requirements, provide UV stable recycled polyester mesh, rectangular shape, inserted in cavity wall open head joints and at the top of the brick (and CMU veneer) walls in the joint between the top of the masonry and the underside of roof deck/edge angle.
 1. Basis of Design: Provide Mortar Net Weep Vents as manufactured by Mortar Net USA, Ltd.; or approved equal.
 2. Color: As selected by Architect from manufacturer's full range. Provide several colors within one wall plane.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
 1. Provide one of the following configurations:
 - a. Strips, full-depth of cavity and 10 inches (250 mm) wide, with dovetail shaped notches 7 inches (175 mm) deep that prevent mesh from being clogged with mortar droppings.
 2. Available Product: Mortar Net USA, Ltd., *Mortar Net*.
- F. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142-inch (3.6-mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
 1. Available Products:
 - a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.

- c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
 - d. Approved equal.
- G. Compressible filler for control and expansion joints in masonry walls: Closed cell polyethylene foam board, soft grade, 25 percent thicker than joint width, continuous in length, and in width to fill the joint from the premolded water stop to a point 3/4" back from face of wall
- H. Termination Bar: Provide 1" flat stainless steel (Type 304) termination bar with holes 8" O.C. to secure flashing in place. Product: Hohmann & Bernard, T1-Termination Bar or approved equivalent.
- I. Slip Sheet: Provide slip sheet for installation with steel lintels and relieving angles. Refer to Section 076200 – Sheet Metal Roofing, Flashing and Trim for slip sheet requirements.
- J. Shims: Provide engineered multipolymer plastic material to be used as a bearing material, spacer and shim.
 - a. Locations: Loose lintel and relieving angle locations where structural component requires a bearing surface.
 - b. Size: Thickness as required to fit within masonry grout joint.
 - c. Product: Provide plastic bearing strips, shim paks & horseshoe spacers as manufactured by Korolath, or approved equal.

2.12 GRAFFITI CONTROL

- A. Provide a clear, water-based silicone emulsion for weatherproofing and graffiti protection on all exterior masonry units.
 - 1. Product: Sure Klean Weather Seal Blok-Guard & Graffiti Control II as manufactured by Prosoco, or approved equal products by W.R. Grace & Co., Master Builders.

2.13 MASONRY CLEANERS

- A. 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.

2.14 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 fol-

lowing types of mortar for applications stated unless another type is indicated.

1. For masonry below grade or in contact with earth, use Type S.
 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.
 4. For interior non-load-bearing partitions, Type O may be used instead of Type N.
- C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
1. Add pigments as required to match sample approved by Architect.
 2. 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 (200 to 280 mm) as measured according to ASTM C 143/C 143M.
- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.15 INSULATION

- A. Rigid Extruded Polystyrene Thermal Insulation: Provide rigid insulation for masonry exterior walls at base flashings in accordance with requirements of Section 072100 – THERMAL INSULATION.

2.16 SOURCE QUALITY CONTROL

- A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:
1. Payment for these services will be made by Owner.
 2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.
- B. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.
- C. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.

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 and 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. 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.
- H. Insulation: Install cavity wall insulation in accordance with section 072100 – THERMAL INSULATION.

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 bond pattern indicated on Drawings; 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. Install site walls in accordance with details on drawings.
- H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.
 - 1. Install compressible filler in joint between top of partition and underside of structure above.
 - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
 - 3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078440 – FIRESTOPPING.

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. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive air barrier membrane, 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 and waterproofing installed in cavity under Division 07.

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 to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Masonry veneer anchoring shall meet seismic requirements of the total wall assembly. Refer to structural Drawings.
 2. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Comply with manufacturer's written installation instructions for installing fastener to ensure air tight penetration through the air vapor barrier. Confirm compatibility of sealant with air /vapor barrier membrane prior to installation. Use two fasteners unless anchor design only uses one fastener.
 3. Embed tie sections in masonry joints. Provide indicated air space between back of masonry veneer and face of insulation.
 4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
 5. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 16 inches (406 mm) o.c. horizontally with not less than 1 anchor for each 1.77 sq. ft. (0.16 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

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.
1. Vertical control joint locations: As shown on Drawings, but no more than 20'-0" on center for exterior locations, and at all corners. and 20'-0" on center for interior locations.
- 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 masonry as follows:
1. Build in compressible joint fillers where indicated.
 2. Install pre-compressed expansion joints in accordance with manufacturer's written installation instructions.
 3. 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. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.

1. For straight sections, provide preformed seals in continuous lengths.
 2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
 3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
 4. Seal transitions according to manufacturer's written instructions.
 5. Install foam seals with adhesive recommended by manufacturer and heat seal all splices.
- E. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.
- F. Seismic Seals: Install interior seals in continuous lengths. Install exterior seal in standard lengths and vulcanize or heat-weld field splice joints to provide watertight joints using manufacturer's recommended procedures. Seal transitions and end joints according to manufacturer's written instructions.
- 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 air barrier membrane, lapping at least 4 inches.
 - a. Install air barrier transition strips to seal embedded flashings in masonry to air barrier membrane in accordance with Section 072500 – AIR BARRIERS.
 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 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.
- E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.
- F. Install vents in head joints in exterior wythes at top of masonry veneer at roof level, at revealing angles and at window heads spaced not to exceed 16 inches o.c., unless otherwise indicated.
- G. Install metal drip edge plate in accordance with architectural details and manufacturer's requirements.
 1. All exposed corners and end conditions of metal through-wall flashing shall be bent and folded down so as to eliminate any sharp corners or edges.

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.
 1. Horizontal Reinforcing for CMU Veneers: Unless otherwise indicated, provide horizontal reinforcing spaced at 16 inches o.c., vertically.
- 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 INSTALLATION OF PRE-CAST CONCRETE UNITS

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Do not install precast concrete units until supporting concrete and masonry has attained minimum design compressive strength.
- C. Precast architectural concrete shall be set in accordance with requirements in section 042000 – Unit Masonry, unless noted otherwise. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently set.
 1. Maintain horizontal and vertical joint alignment and uniform joint width as installation progresses.

- D. Anchor precast architectural concrete units in position by grouting, bolting, welding, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after grouting are completed.
- E. 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.
- F. Erection Tolerances: Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.14 FIELD QUALITY CONTROL

- A. Inspectors: The Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
- B. Testing Agency: The Owner will 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.

3.15 GRAFFITI CONTROL APPLICATION

- A. Apply graffiti control in accordance with manufacturer's written installation instructions.

3.16 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 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.

3.17 MASONRY WASTE DISPOSAL

- A. Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site. Comply with off-site recycling requirements as described in Section 017400 – CLEANING AND WASTE MANAGEMENT.

END OF SECTION

SECTION 04 40 00

SITE STONE

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, the following:

- 1. Granite Steps
- 2. Granite Radius Seat Wall
- 3. Granite Curb

1.3 RELATED WORK

- A. Related work includes, but is not limited to, the following work covered in other sections:

- 1. SECTION 03 30 00 – CAST-IN-PLACE CONCRETE (SITE)
- 2. SECTION 31 00 00 – EARTHWORK
- 3. SECTION 32 13 16 – INTEGRALLY COLORED CONCRETE PAVING
- 4. SECTION 32 14 00 – PRECAST CONCRETE UNIT PAVERS

1.4 REFERENCES

- A. Comply with applicable requirements of:

- 1. State of New Hampshire, Standard Specification for Roads and Bridge Construction, Department of Transportation, latest edition.
- 2. City of Dover, of the State of New Hampshire, and of other authorities having jurisdiction. Provide labor, materials, equipment and services to comply with requirements.
- 3. AASHTO: American Association of State Highway and Transportation Officials.
- 4. NBGQA: National Building Granite Quarries Association.
- 5. ASTM: American Society of Testing Materials:
 - a. C 91 Masonry Cement
 - b. C 94 Aggregate for Masonry Mortar

- c. C 144 Sand
- d. C 150 Portland Cement
- e. C 207 Hydrated Lime for Masonry Purposes
- f. C 270 Mortar for Unit Masonry
- g. C 119 Granite Physical Characteristics
- h. C 615 Granite Physical Characteristics
- i. C 241 Granite Abrasion Resistance
- j. C 97 Granite Absorption
- k. C 170 Granite Compressive Strength
- l. C 99 Granite Modulus of Rupture

1.5 SUBMITTALS

- A. Prepare and submit in accordance with SECTION 01 33 00 – SUBMITTAL PROCEDURES.
- B. Product Data: submit manufacturer's specifications and installation instructions for:
 - 1. Curved Granite Retaining Wall
 - 2. Curved Granite Retaining Wall with Wood Bench
 - 3. Straight and Curved Granite Curb
 - 4. Granite Steps
 - 5. Mortar materials, including additives.
 - 6. Mortar grout materials, including additives.
 - 7. Mortar grout coloring additive.
 - 8. Joint Filler
 - 9. Backer Rod
 - 10. Joint Sealant
- C. Shop Drawings: Submit:
 - 1. Granite and Concrete Foundation Shop Drawings: showing layout, elevations, sections, detailing, finishes, pinning, jointing of granite components and concrete foundations. Drawings to show interface of masonry components with concrete foundations.
- D. Samples: submit:
 - 1. Granite: Provide one 12" square x 1" thick sample for each color and each finish. Samples shall be sufficient to show full range of color, veining and finish to be expected in finished work.
 - 2. Mortar grout coloring additive: Provide samples for selection and approval by Owner's Representative.
 - 3. Joint Sealant: provide samples for selection and approval by Owner's Representative.
- E. Certificates
 - 1. Before commencing work, submit written certificate signed by Contractor stating Contract Documents have been reviewed with qualified representative of granite supplier, and granite supplier is in agreement that selected materials and construction are proper, compatible, and adequate for application shown.
 - 2. Submit materials certificates signed by Contractor stating materials comply with requirements. Provide certificates obtained from granite supplier attesting that granite

meets required physical characteristics. Certification shall be based on independent testing laboratory tests made within last ten years.

1.6 EXAMINATION OF SITE AND DOCUMENTS

- A. Contractor responsible for judging extent of work requirements involved. By submitting bid, Contractor affirms he has carefully examined the site and conditions affecting work.

1.7 PERMITS AND CODES

- A. Work shall conform to Drawings and Specifications and shall comply with applicable codes and regulations.
- B. Arrange for and obtain permits and licenses required to complete Work. Fees not waived shall be paid by Contractor.
- C. Do not close or obstruct streets, sidewalks, alleys or passageways without prior notification and permission. Conduct operations to minimize interference with use of roads, driveways, alleys, sidewalks, or other facilities near enough to Work to be affected.

1.8 QUALITY ASSURANCE

- A. Granite components shall be free of cracks, seams, starts or other defects which impair strength, durability or appearance. Color, texture and finish shall be within range of samples approved by the Owner's Representative.
- B. Granite Installation shall be performed by experienced granite setters under the full time supervision of qualified foreman.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Supplier to carefully pack and band granite for shipment. Following shipping, store granite on skids or pallets, covered with non-staining, waterproof membrane and protected from weather. Evenly place and stack skids to evenly distribute weight of granite materials and to prevent breakage, cracking, and damage to granite pieces. Store granite materials to allow air to circulate around granite material. Granite shall not be permitted to be in direct contact with ground during storage.
- B. Handle, store, mix and apply setting materials in strict compliance with manufacturer's recommendations and instructions.
- C. Damaged granite/precast concrete components will be rejected and replaced with new materials at no additional cost to Owner.
- D. Protect finished surfaces adjacent to paving work from soiling, staining, and other damage.

1.10 PROJECT CONDITIONS

- A. Cold Weather Protection:
 - 1. Remove ice or snow formed on granite and concrete bed by carefully applying heat until top surface is dry to touch.
 - 2. Remove granite work determined to be damaged by freezing conditions.

3. Perform the following construction procedures while work is progressing:

Air Temperature	Procedures
40° - 32°F.	Heat sand to produce mortar temperature between 40° and 120°F.
32° - 25°F.	Heat sand to produce mortar temperature between 40° and 120°F. Maintain temperature of mortar on boards above freezing.
25° - 20°F.	Heat sand to produce mortar temperature between 40° and 120°F. Maintain temperature of mortar on boards above freezing. Use wind breaks when wind is in excess of 15 mph.
20°F – below	Heat sand to produce mortar temperature between 40° and 120°F. Provide enclosures and auxiliary heat to maintain air temperature above 32°F. Do not lay units which have a surface temperature below 20°F.

4. Keep latex admixture at 40°F. minimum.

B. Cold Weather Protection for Completed Granite Work:

1. Perform the following construction procedures while work is progressing:

Mean Daily Air Temperatures	Procedures
40° - 32°F.	Protect granite work from rain or snow for at least 24 hours by covering with weather-resistant membrane.
32° - 25°F.	Completely cover granite work with weather - resistive membrane for at least 24 hours.
25° - 20°F.	Completely cover granite work with insulating blankets or similar protection for at least 24 hours.
20°F. - below	Maintain granite work at temperature above 32°F. for 24 hours using enclosures and supplementary heat.

2. Do not use frozen materials or materials mixed or coated with ice or frost. Do not lower freezing point of mortar by use of admixtures or antifreeze agents, and do not use calcium chloride in mortar or grout.
3. Do not build on frozen work; remove and replace granite work damaged by heat or freezing.
4. Protect partially completed granite work against weather when work is not in progress.

PART 2 - PRODUCTS

2.1 GRANITE

- A. Granite: comply with requirements of NBGQA for tolerance, color and finish qualities, unless indicated otherwise. Provide continuous blocks of granite to allow for fabrication of continuous matching units. Mark matched units to provide continuous sequence installation.
- B. Certification of Specified Physical Characteristics of Granite:
 - 1. Provide first quality granite, hard and durable, of uniform or similar color, grain, size and texture, free from seams, cracks and other imperfections, and having smooth splitting character. Provide clean stone which shows no evidence of rust or iron particles. Test samples conforming to ASTM C615 requirements.
 - 2. Provide granite materials having characteristics and physical requirements defined by ASTM C119 and C615 and physical characteristics defined under ASTM C614 Table 1 according to the following ASTM test references:
 - a. Abrasion resistance of stone subject to foot traffic: ASTM C241.
 - b. Absorption of natural building stone: ASTM C97.
 - c. Compressive strength of natural building stone: ASTM C170.
 - d. Modulus of rupture of natural building stone: ASTM 99.
 - 3. Provide granite conforming to the following requirements:
 - a. Abrasion: 21.08 Ha.
 - b. Absorption: 0.27% (average)
 - c. Compressive strength: 18,113 psi (average)
 - d. Modulus of rupture: 1,500 psi (average)
- C. Granite Type and Finishes as follows:
 - 1. Granite Steps, Granite Radius Seat Wall and Granite Curb
 - a. Granite type: Woodbury Gray, as supplied by Swenson Granite Works, 369 North State Street, Concord, NH 03301. Phone: (603) 228-4322. Store manager Brian Ahern email: bahern@swensongranite.com
 - b. All exposed surfaces: Sawn and thermal finish
- D. Appearance Criteria:
 - 1. Color Criteria: Samples shall be sufficient to show full range of color for permissible range of variation in color provided by lightest and darkest color samples.
 - 2. Variation in Graining Criteria: Samples shall be sufficient to show permissible variation in graining and pattern.
 - 3. Markings, inclusion characteristics and veining criteria: Samples shall be sufficient to show permissible inclusions provided by a maximum size for inclusions, a maximum number of inclusions per piece and maximum number of inclusions for one face. Criteria for finish provided by samples.

4. Finishes criteria: Samples shall be sufficient to show full range of color for permissible range of finish variation.
5. Variation outside of established criteria:
 - a. In the case of more or less variegated color range, markings and inclusion characteristic stones, color photos shall be submitted in addition to the number of samples to show the full range of color to be expected.
 - b. Select color range involving markings, inclusion characteristics, veining and grain deviations from the standard quarried natural full stone range shall be pre-determined by Engineer in a review of quarry's standard quarried stone mock up photo that is kept on file. Final custom select color range, markings, inclusion characteristics, veining, grain and finishes shall be reviewed and determined first in a photo mock-up prior to final site mock-up. Final approval will be as selected and approved by Engineer.
- D. Cut, fabricate and finish granite by skilled masons. Cut granite to allow for uniform joint widths. Dress joints, bed and vertical, straight and at 90 degree angle to face unless shown otherwise.

2.2 SETTING BED

- A. Setting bed mortar shall conform to ASTM C 270, Type S, except that latex polymer additive shall be mixed with cementitious materials and aggregate in lieu of water.
 1. Cement: conform to ASTM C 150, Type I, complying with the staining requirements of ASTM C 91 for not more than 0.03% water soluble alkali. Furnish Type I, except Type III may be used for setting granite in cold weather.
 2. Sand: conform to ASTM C 144.
 3. Hydrated lime: conform to ASTM C 207.
 4. Latex polymer additive: one of the following:
 - a. Laticrete #3701 Mortar manufactured by Laticrete International, Woodbridge, CT.
 - b. Hydroment Acrylic Mortar Admixture supplied by Bostik, Middleton, MA.
 - c. Silpro #C21 manufactured by Silpro Masonry Systems, Ayer, MA.

2.3 GROUTED JOINTS

- A. Mortar grout for pointing of joints: consist of one part white Portland cement, two parts sand, mortar coloring additive, gauged with latex polymer additive.
 1. White Portland cement; ASTM C 150, complying with staining requirements of ASTM C 91 for not more than 0.03% water soluble alkali. Furnish Type I, except Type III for setting granite in cold weather.
 2. Mortar coloring additive: SGS colors, manufactured by Solomon Grind Chem Service, Springfield, IL 62705. Mortar coloring additive shall have mineral oxide pigment and be certified by supplier to be resistant to alkali, light, and weather, and be of a chemical composition unaffected by cement and free of water and soluble salts. Color pigment shall not exceed 10% of Portland cement in mortar. Color of mortar shall be approved by Architect.

3. Latex polymer additive: one of the following:

- a. Laticrete #3701 manufactured by Laticrete International, Woodbridge, CT.
- b. Grout Additive supplied by Bostik, Middleton, MA.
- c. Silpro #C21 manufactured by Silpro Masonry Systems, Ayer, MA.

2.4 STONE CONCRETE ANCHORS

- A. Stone Anchors: Provide type and sizes shown on Drawings. If not shown, provide size and type required to securely anchor and fasten stonework in place. No anchors less than 16 gauge. Fabricate anchors, cramps and from AISI type 302/304 stainless steel. Dowels conform to ASTM 276 and A479 for type 304 stainless steel. Devices shall be manufactured by one of the following:

1. Hohmann and Barnard, Inc., Hauppauge, NY 11787
2. The Weston Company, Route #215, P.O. Box 397, Gainesville, VA 22065, phone #703.349.1200
3. Dur-O-Wal, Inc., 601 North Point Road, Baltimore, MD 21237, phone #800.368.2035.

2.5 SETTING BUTTONS

- A. Setting Buttons: Provide thicknesses required for joint size indicated and required to maintain uniform width. Provide buttons manufactured by one of the following:

1. Hohmann and Barnard, Inc., Hauppauge, NY 11787
2. The Weston Company, Route #215, P.O. Box 397, Gainesville, VA 22065, phone #703.349.1200
3. Dur-O-Wal, Inc., 601 North Point Road, Baltimore, MD 21237, phone #800.368.2035.

2.6 STONE CLEANING MATERIALS

- A. Granite cleaning materials: Acceptable materials include mild soap and water, non-acid type cleaners and stiff fiber brushes. Wire brushes and caustic cleaners are unacceptable. Provide one of the following:

1. Sure Clean #600 Detergent manufactured by ProSoCo, Inc., Kansas City, KS
2. #101 Masonry Restorer/Cleaner manufactured by Diedrich Chemicals and Restoration Technologies, Inc, 300 A East Oak Street, Oak Creek, WI 53154.

2.7 PORTLAND CEMENT CONCRETE PRODUCTS

- A. Portland cement concrete products: specified in SECTION 03 30 00 – CAST-IN-PLACE CONCRETE (SITE).

2.8 PORTLAND CEMENT MIXES

- A. Portland cement paving mixes: specified in SECTION 03 30 00 – CAST-IN-PLACE CONCRETE (SITE).

2.9 EXPANSION DOWELS AND SLEEVES

- A. Expansion dowels and sleeves: Stainless steel bars, complying with ASTM A276, Type 304 with smooth end cuts. Provide expansion caps with compatible waxed tube sleeve which permit at least one inch movement.

2.10 GRAVEL BASE

- A. Gravel Base: specified in Section 31 00 00 – Earthwork.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation with layout and installation of adjacent paving, curbing, walls and other site improvements to ensure proper alignments.
- B. Make corrections as required to gravel base specified under SECTION 31 00 00 – EARTHWORK, to bring gravel fill base to proper sections and elevations
- C. Develop and submit shop drawings showing granite, bluestone, brick and precast concrete components and concrete foundations and their relationships. Do not place concrete foundations until shop drawings have been approved for granite, bluestone, brick and precast concrete components and concrete foundations.
- D. Coordinate layout and top of concrete foundation with granite component fabrication and jointing between components.
- E. Install reinforced concrete foundations as specified under SECTION 03 30 00 – CAST-IN-PLACE CONCRETE (SITE)., to proper lines and elevations.

3.2 INSTALLATION

- A. Clean stone components before setting with fiber brushes and mild cleaning compounds to be free of dirt and foreign matter. Following cleaning rinse clean with clear water. Granite shall be dry before setting.
- B. Do not use stone components with chips, cracks, voids, stains and other defects which may be visible in finished work and structurally impair stone.
- C. Follow manufacturer's instructions for mixing and applying mortar, mortar grout and latex polymer additive according to manufacturer's instructions. Mix pigment and mortar grout according manufacturer's instructions.
- D. Set stone components and provide attachments to secure stone components. Shim and adjust true to line and grade with uniform joint thickness. Fill holes, slots and other sinkages for anchors, dowels, fasteners and supports with mortar during granite setting. Direct bearing contact between stone pieces shall be prohibited.
- E. Spread mortar over full width of vertical joints for stone components set in full mortar bed. Before setting, stone masonry pieces to be dampened and receive slurry of mortar to ensure maximum contact with mortar bed. Exercise particular care to equalize bed and joint openings and eliminate need for redressing of exposed surfaces.

- F. Keep exposed surfaces free from mortar. Immediately remove mortar smears with clean sponge and clean water before latex modified mortar sets.
- G. Joints except expansion joints shall be completely filled with mortar, then raked to depth not less than 3/4 inch. Brush clean and point raked joints with colored mortar to flat cut joint. Mortar grout between stone pieces shall be uniform in appearance, texture, and color. After initial set of mortar, joints shall be finished by tooling with rounded, non-staining jointer to produce glassy-hard, polished, slightly concave joint, free of drying cracks.
- H. After pointing, carefully clean granite work to remove dirt, excess mortar and stains. Clean expansion joints to be free of mortar and left ready for sealing of joints.
- I. Install joint materials according to manufacturer's recommendations.
- J. Upon completion of stone masonry installation, leave in clean, unsoiled condition, acceptable to the Owner's Representative.

3.3 ADJUST AND CLEAN

- A. Remove and replace stone pieces which are broken, chipped, stained and otherwise damaged. Remove and replace units which are misaligned, not to grade and do not match adjoining stone work. Provide new matching units, install and point-up joints to eliminate evidence of replacement. Repair defective and unsatisfactory joints to provide neat, uniform appearance.
- B. Keep exposed surfaces free from mortar. Immediately remove mortar smears with clean sponge and clean water before latex modified mortar can set. Sweep areas of stone on setting bed clean of excess sand.
- C. Clean stone work to remove stains, excess mortar, dirt and other discoloration or blemishes. Commence cleaning operations following a minimum 28 day curing period for granite construction. Follow manufacturer's instructions for use, handling and application of masonry cleaners. Provide polyethylene covers or other temporary protection of lawn, plants and other non-working areas adjacent to masonry cleaning. Remove coverings immediately following cleaning operations. Collect and remove residual cleaning solutions from site.

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 SUMMARY

- A. The work of this Section consists of furnishing and erecting all structural steel work and Exposed to View Structural Steel (EVSS) work 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, and other similar pieces.
- 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 Exposed to View Structural Steel work (EVSS). Coordinate locations of all EVSS 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.

1.3 RELATED SECTIONS

- A. 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 055100 - METAL STAIRS.
- 7. Section 078100 - APPLIED FIREPROOFING.
- 8. Section 099000 - PAINTING AND COATING.

1.4 REFERENCES (LATEST EDITIONS)

- A. "Code of Standard Practice for Steel Buildings and Bridges - 2005" and "Specifications for the Design, Fabrication and Erection of Structural Steel Buildings - 2005" by the American Institute of Steel Construction.
- B. The "Seismic Provisions for Structural Steel Buildings - 2005" by the American Institute of Steel Construction, Inc.
- C. The "Connections Manual of Steel Construction" by the American Institute of Steel Construction, Inc.
- D. The "Specifications for Structural Joints Using High-Strength Bolts – 2009" by the Research Council on Structural Connections (RCSC).
- E. "Structural Welding Code – Steel - 2008" by the American Welding Society.
- F. ASTM listed standards by the American Society for Testing and Materials.
- G. SSPC listed standards by the Steel Structures Painting Council.
- H. 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.
- I. 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.

1.5 LEED BUILDING – GENERAL REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental goals, which include achieving a LEED Building Silver rating under the "U.S. Green Building Council's (USGBC) LEED for Schools, Version 2009". Specific project goals which may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes substantially compromise the stated LEED BUILDING criteria.

B. LEED-S Product Requirements:

1. MR Credit 4, Recycled Content. (See Section 018113 Sustainable Design Requirements for overall project recycled content requirements.) Contractor shall examine each product or material specification below for a stated minimum recycled content requirement, and if none is stated, the requirements under 018110-SUSTAINABLE DESIGN REQUIREMENTS shall govern. Submit a completed MCDS for recycled content for all materials in this section.
2. MR Credit 5, Regional Content. (See Section 018113 Sustainable Design Requirements for overall project regional content requirements.) Contractor shall examine each product or material specification below for a stated minimum regional content requirement, and if none is stated, the requirements under 018110-SUSTAINABLE DESIGN REQUIREMENTS shall govern. Submit a completed MCDS for regional content for all materials in this section.

C. LEED BUILDING Performance Criteria: The following criteria are required for the products included in this section:

1. Steel shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
2. Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.

1.6 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. LEED-S Submittal requirements:

1. Submit completed LEED-S Materials Credits Documentation Sheet (MCDS, see SECTION 018110 - SUSTAINABLE DESIGN REQUIREMENTS) for applicable material requirements as stated under “Products” in this Section, and as may be required in SECTION 018113 – SUSTAINABLE DESIGN REQUIREMENTS. Submit all required backup documentation.
 2. Product substitution requests are subject to additional LEED-S submittal requirements; see SECTION 012500 – SUBSTITUTION PROCEDURES.
- C. 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.
- D. Prior to preparation of Shop Drawings, the fabricator shall submit typical details of all structural steel and Exposed to View 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, and other similar details 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.

- E. Prior to submission of Shop Drawings, Contractor shall verify all dimensions, site conditions, and other similar pertinent information 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.
- F. 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.
- G. Shop Drawings shall include all information required for fabrication of the component parts of the structure. Erection drawings shall clearly indicate all EVSS 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 EVSS members.
- H. 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.
- I. 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.
- J. 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 is subject to the following conditions:
 - 1. The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 - 2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 - 3. The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.
- K. Reports: Submit certified copies of mill test reports for all structural steel furnished.

- L. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order.

1.7 LEED SUBMITTALS

- A. The contractor, subcontractor, and/or product manufacturer shall submit LEED BUILDING certification items in accordance with Section 018110 – SUSTAINABLE BUILDING REQUIREMENTS.

1.8 MOCKUPS

- A. At least four (4) weeks prior to fabricating EVSS, 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 approved by the Architect may be part of the completed structure.
 - 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 EVSS work.

1.9 QUALITY ASSURANCE

- A. Qualifications: The steel fabricator and erector conducting the work of this Section shall be AISC certified and experienced in fabricating EVSS 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.

1.10 SUBSTITUTIONS

- A. Substitutions or any modifications of details proposed by Contractor will be considered by Architect only under the requirements of SECTION 013300 – SUBMITTAL PROCEDURES 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 W and WT shapes shall comply with the requirements of ASTM A 992 or A 572 - Grade 50 (50 ksi minimum yield) for Structural Steel. Structural steel plates and shapes other than W and WT shapes shall comply with ASTM A 36 (36 ksi minimum yield). Square and rectangular steel tubing shall comply with ASTM A 500 - Grade C (50 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 except A325, Type SC at slip-critical connections indicated on the drawings.
- 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, Wedge Bolt by Powers Fastening Systems, or an equal approved by the Architect.
- E. Adhesive 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 such as "Plastic Steel" manufactured by ITW Devcon Corporation, "Scotch-Weld Adhesive 1751" by the 3M Corporation, or an equal approved by the Architect.
- G. Thermal isolating sheets/washers shall be fiber-reinforced structural thermal breaks such as "Fabreeka-TIM" by Fabreeka, "Armatherm FR" by Armadillo, "Farrat TBK" by Farrat, or equal approved by the Architect.

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 to the requirements listed in this specification. Provide continuous welded joints in EVSS members. The welds shall be ground or otherwise treated as required to blend with adjacent parent metal. In addition, fabricate as follows:
 - 1. Fabricate EVSS with exposed surfaces smooth, square and of surface quality with the approved mockups. Use special care in handling and shipping EVSS before and after shop painting.
 - 2. Fabricator shall grind welds of EVSS 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. All exposed welds shall be continuous, unless otherwise noted on the Drawings. All weld show-through shall be minimized by grinding and filling the far side with metallic filler as required to provide a smooth unblemished surface. Joint gaps between abutting members shall be uniform and minimized to $1/8"$.
 - 5. Fabricate EVSS 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, and/or other steel 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, and/or other steel necessary around all openings in roof deck at drains, fans, and other similar openings 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.
- N. Vent holes for HSS members to be galvanized shall be located at lower elevations/sides of members and at areas not exposed to view. Vent holes shall be plugged following galvanizing with a durable material to match the appearance of the surrounding galvanizing. Vent hole plugs shall prevent moisture entering the HSS members.

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 not exposed to view structural steel shall be in accordance with "Steel Structures Painting Council Surface Preparation No. 3, Power Tool Cleaning." and shall be left unprimed.
- C. Surface preparation for interior Exposed to View Structural Steel (EVSS), structural steel to fireproofed with intumescent paint and all exterior exposed 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 10-09 Modified Alkyd Primer (grey color), Sherwin Williams High Solids Alkyd Metal Primer B50WZ3 (off-white color), Benjamin Moore Super Spec HP Metal Primer KP14-70 (grey color), or equivalent as approved by the Architect.
 - E. Primer for exterior structural steel over galvanizing that is exposed to view shall be "TNEMEC" 27-FC TYPOXY primer (4.0-6.0 mils d.f.t.), or an equivalent approved by the Architect.
 - F. Primer for structural steel that will remain exposed to view and is scheduled to be fireproofed with intumescent paint shall be compatible with the intumescent paint manufacturer, and as approved by the Architect.
 - 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 1.5 mils at non-exposed areas and 3.0 to 3.5 mils at exposed areas. 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 078100 APPLIED FIREPROOFING Section 099000 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. All hollow members that have been galvanized should have their vent holes plugged solid, ground smooth and touched up with a zinc rich primer paint.
 - 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 (EVSS) shall be erected in accordance to the following:
 - 1. Grind all field welds of EVSS 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.
- L. Install fiberglass-reinforced laminate composite thermal isolated shims/plates at all exterior steel to interior steel connections and as shown on the Drawings.

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 (such as rolling, fabrication, and erection) 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 Exposed to View Structural Steel (EVSS) shall not exceed one-half those permitted for structural steel.

END OF SECTION

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 SUMMARY

- A. 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.

1.3 RELATED SECTIONS

- A. 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.

1.4 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.

1.5 LEED BUILDING – GENERAL REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental goals, which include achieving a LEED Building Silver rating under the "U.S. Green Building Council's (USGBC) LEED for Schools, Version 2009". Specific project goals which may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes substantially compromise the stated LEED BUILDING criteria.
- B. LEED BUILDING Performance Criteria: The following criteria are required for the products included in this section:
 - 1. Steel shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
 - 2. Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.

1.6 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES.
- B. LEED Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018110 – 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 018110.
 - 2. Show installed costs for all items listed.
- C. Shop Drawings shall indicate size and position of all shear connectors. Shop Drawings shall indicate fastening methods for connectors.
- D. 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.
- E. 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.
- 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 subject to the following conditions:
 - (1) The entity producing the Shop and Coordination Drawings (The "User") agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any

warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.

- (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
- (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

1.7 LEED SUBMITTALS

- A. The contractor, subcontractor, and/or product manufacturer shall submit LEED BUILDING certification items in accordance with Section 018110 – SUSTAINABLE BUILDING REQUIREMENTS.

1.8 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 SUMMARY

- A. The work of this Section consists of furnishing and erecting all steel joist framing as shown on the Drawings and as specified herein and includes, but is not limited to, the following:
 - 1. Steel joists, K-Series.
 - 2. Longspan steel joists, LH-Series and 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 and 013300 SUBMITTAL PROCEDURES for material, procedure, and documentation submittal requirements.
 - 2. Refer to Section 018119 – INDOOR AIR QUALITY REQUIREMENTS, for material and procedure requirements.

1.3 RELATED SECTIONS

- A. 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.

1.4 REFERENCE STANDARDS

- 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.

1.5 LEED BUILDING – GENERAL REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental goals, which include achieving a LEED Building Silver rating under the "U.S. Green Building Council's (USGBC) LEED for Schools, Version 2009". Specific project goals which may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes substantially compromise the stated LEED BUILDING criteria.
- B. LEED-S Product Requirements:
 - 1. MR Credit 4, Recycled Content. (See Section 018113 Sustainable Design Requirements for overall project recycled content requirements.) Contractor shall examine each product or material specification below for a stated minimum recycled content requirement, and if none is stated, the requirements under 018110- SUSTAINABLE DESIGN REQUIREMENTS shall govern. Submit a completed MCDS for recycled content for all materials in this section.
 - 2. MR Credit 5, Regional Content. (See Section 018113 Sustainable Design Requirements for overall project regional content requirements.) Contractor shall examine each product or material specification below for a stated minimum regional content requirement, and if none is stated, the requirements under 018110- SUSTAINABLE DESIGN REQUIREMENTS shall govern. Submit a completed MCDS for regional content for all materials in this section.
- C. LEED BUILDING Performance Criteria: The following criteria are required for the products included in this section:

1. Steel shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
2. Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.

1.6 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. LEED-S Submittal requirements:
 1. Submit completed LEED-S Materials Credits Documentation Sheet (MCDS, see SECTION 018110 - SUSTAINABLE DESIGN REQUIREMENTS) for applicable material requirements as stated under “Products” in this Section, and as may be required in SECTION 018113 – SUSTAINABLE DESIGN REQUIREMENTS. Submit all required backup documentation.
 2. Product substitution requests are subject to additional LEED-S submittal requirements; see SECTION 012500 – SUBSTITUTION PROCEDURES.
- C. 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.
- D. 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.
- E. 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.
- 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 is subject to the following conditions:
 1. The entity producing the Shop and Coordination Drawings (The “User”) agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 2. The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 3. The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or relate to) the use,

misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.

- G. Reports: Submit certified copies of mill test reports for all structural steel furnished.
- H. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order.

1.6 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, nor 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.

1.7 LEED SUBMITTALS

- A. The contractor, subcontractor, and/or product manufacturer shall submit LEED BUILDING certification items in accordance with Section 018110 – SUSTAINABLE BUILDING REQUIREMENTS.

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.
- D. Design all joists, bridging, anchorage, etc. for net wind uplift pressures as indicated on the Drawings.

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 as specified in Section 099000 – PAINTING AND COATING.
- 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. K-series steel joists shall be welded to steel supports with two (2) 3/16" welds, each at least two and a half (2.5) inches long.
- C. Longspan and Deep Longspan steel joists shall be welded to steel supports with two (2) 1/4" welds, each at least three (3) inches long.
- D. All bridging shall be installed in accordance with the Reference Specifications and as shown on the Drawings.
- E. 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

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 SUMMARY

- A. The work of this Section consists of furnishing and installing all metal deck work as shown on the Drawings and as specified herein and includes, but is not limited to, the following:
 - 1. Metal roof deck.
 - 2. Cellular acoustic metal roof deck.
 - 3. Metal form deck.
 - 4. Metal floor deck.
 - 5. Roof deck accessories: finish strips, butt strips, ridge plates, valley plates, splice plates, side lap screws, sump pans, acoustical batts and rubber closures.
 - 6. Floor deck accessories: finish strips, butt strips, closures and pour stops.
 - 7. Field touch-up paint after erection.

1.3 RELATED SECTIONS

- A. 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.
 - 6. Section 078100 - APPLIED FIREPROOFING.
 - 7. Section 099000 - PAINTING AND COATING.

1.4 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.

1.5 LEED BUILDING – GENERAL REQUIREMENTS

- A. The Owner requires the Contractor to implement practices and procedures to meet the project's environmental goals, which include achieving a LEED Building Silver rating under the "U.S. Green Building Council's (USGBC) LEED for Schools, Version 2009". Specific project goals which may impact this area of work include: use of recycled-content materials; use of locally-manufactured materials; use of low-emitting materials; construction waste recycling; and the implementation of a construction indoor management plan. The Contractor shall ensure that the requirements related to these goals, as defined in the sections below and in Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS, are implemented to the fullest extent. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes substantially compromise the stated LEED BUILDING criteria.
- B. LEED BUILDING Performance Criteria: The following criteria are required for the products included in this section:
 - 1. Steel shall contain a minimum of 25% (combined) post-industrial/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials). Certification of recycled content shall be in accordance with the Submittal Requirements.
 - 2. Steel manufactured within 500 miles (by air) of the project site shall be documented in accordance with the Submittal Requirements.

1.6 SUBMITTALS

- A. Submit complete Shop Drawings in accordance with the provisions of Section 013300 – SUBMITTAL PROCEDURES.
- B. LEED Submittal: For each product specified, fill out the Materials Submittal Cover Sheet – See Section 018110 – 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 018110.
 - 2. Show installed costs of all items listed.
- C. 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.

- D. Shop Drawings shall also show all accessories and methods of attachment to the building frame.
- E. 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.
- F. 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.
- 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 subject to the following conditions:
 - (1) The entity producing the Shop and Coordination Drawings (The “User”) agrees to accept the reproduced information from Foley Buhl Roberts & Associates, Inc. without any warranties, guarantees and/or representations of any nature whatsoever regarding the correctness, dimensional and/or quantitative accuracy and/or completeness of any such information contained therein.
 - (2) The User further agrees that such information shall be used as reference material only for the production of Shop and Coordination Drawings for the referenced project to which this Specification applies and only for that project.
 - (3) The User further agrees to release, indemnify, hold harmless and defend Foley Buhl Roberts & Associates, Inc. with respect to any claims, costs (including the cost of litigation), losses, damages and/or liabilities which arise from (or related to) the use, misuse, modification, interpretation, misinterpretation and/or misrepresentation of the reproduced information.
- H. Mill certification for pre-consumer and post-consumer recycled content percentage; request at time of order.

1.7 LEED SUBMITTALS

- A. The contractor, subcontractor, and/or product manufacturer shall submit LEED BUILDING certification items in accordance with Section 018110 – SUSTAINABLE BUILDING REQUIREMENTS.

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

- D. The Contractor shall give proper notice to inspection agencies designated by the Architect and shall allow access and full facilities for this inspection.
- E. A final report shall be issued by the testing agency following the completion of the work in this Section.

PART 2 - PRODUCTS

2.1 METAL ROOF DECK

- A. Typical metal 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. All metal roof deck shall have a maximum nominal top-side gap between flutes of 2 3/4". Galvanized coating shall conform to ASTM A 653 G 60. See Drawings for deck type, gauge and depth.
- B. Acoustic metal 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. All metal roof deck shall have a maximum nominal top-side gap between flutes of 2 3/4". 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. To facilitate field painting of perforated surfaces, the sound absorbing elements shall be supported above the surface by spacers. 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 metal roof deck units shall be cut 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 metal roof 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.
- E. Accessory metal sections shall be of the same material, gauge and finish as the metal 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 METAL FLOOR FORM DECK

- A. Units shall be formed of steel sheets conforming to ASTM A 653 SS Grade 80 and shall be UFS type with 13/16" wide (nominal) flutes top and bottom sides at 2 1/2" on center and with a minimum yield strength of 80,000 psi with overlapping side lap. Galvanized coating shall conform to ASTM A 653 G 60. See Drawings for deck gauge and depth.
- B. 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.

- C. The deck manufacturer shall be selected to meet strength requirements during concrete placement and provide temporary shoring as required.
- D. Accessory metal sections shall be of the same material, gauge and finish as the metal deck units, unless otherwise indicated.
- E. Pour stops shall be not lighter than 18 gauge and be of the same material and finish as the metal deck units. Use heavier gauge where indicated on the Drawings.

2.3 COMPOSITE METAL FLOOR DECK

- A. Typical metal floor deck shall be formed of steel sheets conforming to ASTM Standard A 653 minimum Grade 40 and shall be the composite type with 6" wide (nominal) flutes top and bottom sides at 12" on center, and 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. Units shall have vented bottom flutes. Vent openings shall account for 0.5% of the surface area covered by the decking. Products used shall be Factory Mutual – Global approved.
- B. Cellular acoustic metal floor deck shall be formed of steel sheets conforming to ASTM Standard A 653 minimum Grade 40 and shall be composite type with 6" wide (nominal) flutes top and bottom sides at 12" on center and with a minimum yield strength of 40,000 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 gauge and depth. Products used shall be Factory Mutual – Global approved.
- C. Metal 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.
- D. Cellular acoustic metal floor 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. The deck manufacturer shall be selected to meet strength requirements during concrete placement and shall provide temporary shoring for spans where indicated on the plans.
- F. Accessory metal sections shall be of the same material, gauge and finish as the metal deck units, unless otherwise indicated.
- G. Pour stops shall be not lighter than 18 gauge and be of the same material and finish as the metal deck units. Use heavier gauge where indicated on the Drawings.
- H. All exposed surfaces shall be shop primed and ready for job site finish painting.

2.4 PROTECTIVE COATINGS

- A. Metal deck units shall be cleaned of scale, rust, grease, oil or other foreign matter and be given a phosphate conversion coating. Metal deck surfaces to remain exposed to view, shall then be shop coated with an approved primer and oven baked.

- B. Acoustic metal deck units exposed to view in the finish work shall be cleaned of scale, rust, grease, oil or other foreign matter and be given a phosphate conversion coating. Acoustic metal deck shall then be shop coated with approved synthetic enamel primer and baked.
- C. Shop and field touch-up paint shall be verified by the field painting contractor for compatibility with approved field top coat paints under the Section 09 90 00 PAINTING AND COATING.

PART 3 - EXECUTION

3.1 STORAGE

- A. Care and protection shall be given to all metal 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 and should be stored with a sloping ventilated waterproof covering.

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 metal 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. When metal deck units are 22 gauge or lighter, use welding washers to connect all metal deck material to supporting steel.
- D. Typical metal 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 metal 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 1/2" long seam welds between supports at intervals not exceeding twenty-four (24) inches.
- F. Typical metal floor form deck units shall be fastened to the supporting structure (minimum requirements) as follows:
 - 1. Panel ends and end laps: Welded at maximum spacing of fifteen (15) inches.

2. Intermediate supports: Welded at maximum spacing of fifteen (15) inches.
 3. Longitudinal edges at marginal supports: Welded at maximum spacing of fifteen (15) inches.
 4. Side laps of adjacent units: Screw fastened between supports at intervals not exceeding fifteen (15) inches.
- G. Typical composite metal 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 between supports at intervals not exceeding thirty (30) inches.
- H. Fasten accessories to deck by welding.
- I. Fasteners for overlying roofing material shall be concealed within the depth of the roof deck ribs.
- J. 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. No architectural, mechanical, electrical, plumbing, fire protection or other components shall be hung from metal roof deck.
- K. 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.
- L. 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.
- M. Install rubber closures in all roof deck flutes over exterior walls.
- N. Provide field fabricated sheet closures at all perimeter and interior columns, breaks at perimeter pour stops, and at all similar locations for a complete job.

END OF SECTION 053100

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.
- 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 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 wall framing.
 - 2. Interior load bearing framing for stepped risers and platforms where indicated.
 - 3. Interior long span partitions where indicated.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for masonry shelf angles and connections.
 - 2. Section 06100-ROUGH CARPENTRY for carpentry related to raised steps and platform framing.
 - 3. Section 061600 - SHEATHING for exterior sheathing applied to cold-formed metal framing.
 - 4. Section 092900 - GYPSUM BOARD ASSEMBLIES for interior non-load-bearing, metal-stud framing and ceiling-suspension 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 and as indicated on structural drawings.
 - 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 $L/600$ of the member span for exterior masonry veneer wall systems, and $L/360$ for non- masonry veneer exterior wall systems, unless otherwise indicated.
 - b. Interior-Load-Bearing Framing:
 - 1) 60 lbs/sf load.
 - 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. 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. Provide P.E. stamped shop drawings and P.E. stamped calculations for all members and all connections and supports.
- C. 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.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.
- F. 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 structural 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.
- G. Steel thicknesses specified below are minimum. Provide heavier gauges as required to meet design loads, and where indicated.

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. Clark Steel Framing.
 2. Consolidated Fabricators Corp.; Building Products Division.
 3. Dietrich Metal Framing; a Worthington Industries Company.

4. MarinoWare; a division of Ware Industries.
5. Super Stud Building Products Inc.

2.2 MATERIALS

- A. 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.
- B. 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. Environmental Requirement: Provide steel studs and components with a minimum recycled content of 60 percent.
- B. 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:
 - a. Typical: 0.0598 inch (16 gauge).
- C. 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.
- D. 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. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. The Steel Network, Inc.
- E. Deflection Track: Manufacturer's deep-leg, U-shaped steel tracks with 2" long legs, minimum 14 gauge thickness.

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. Wall stud tracks anchor spacing to structure shall be no further apart than the stud spacing, 16" max.
- 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.

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.

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 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, unless closer spacing is indicated or required by engineering calculations.
 - 2. Wall stud tracks anchor spacing to structure shall be no further apart than the stud spacing, 16" max, unless closer spacing is required by engineering calculations.
 - 3. Provide double studs at walls 15 feet and over, spacing as indicated on drawings or if not indicated as required to meet design load requirements.
 - 4. Do not screw the stud to the top deflection track
 - 5. Allow for a minimum of $\frac{3}{4}$ " vertical structure live load deflection
 - 6. Provide continuous top of stud wall bridging/ bracing 12" max below top tracks.
 - 7. Provide built-up jambs consisting of multiple stud/track sections at all window and door jamb conditions. Install multiple anchors to concrete at bottom track and reinforce top, deep leg deflection track as required by engineering calculations.
- 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 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 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 this Section, including Schedule in Paragraph 2.1 of this Section.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for concrete fill in metal pan stairs and platforms and fixed site bollards.
 - 2. Section 051200 - STRUCTURAL STEEL FRAMING for structural steel items.
 - 3. Section 129300 - SITE FURNISHINGS for site bollards.
 - 4. Section 330000 - SITE UTILITIES for electrical equipment bollard detail.
- 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.

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. 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 $L/360$.
- 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.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- F. 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 all specified items.
- B. 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.
 - a. 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. Provide P.E. stamped shop drawings and P.E. stamped calculations for all members and all connections and supports.
- C. Welding certificates.
- D. Qualification Data: For professional engineer licensed in the project location.

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 metal fabrications that are similar to those indicated for this Project in material, design, and extent.

- C. 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. Preambled Stairs: Commercial class.
 - 2. Ornamental Stairs: Architectural class.
- D. 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."
- E. 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.
- C. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the stair enclosure.

PART 2 - PRODUCTS

2.1 SCHEDULE

- A. Miscellaneous and ornamental items include the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.
 - 1. Galvanized loose steel lintels with shop-applied primer at exterior locations. Refer to structural drawings for size and configuration.

2. Loose steel lintels with shop-applied zinc-rich primer at interior locations. Refer to structural drawings for size and configuration.
3. Elevator sill support angle at finish floor levels, shop-primed.
4. Miscellaneous steel framing and supports, shop-primed, (shop-primed and galvanized at exterior locations, in exterior walls, and at interior locations subject to moisture (Kitchen), and as indicated:
 - a. Steel framing and supports for OT/PT Room grid and curtain tracks.
 - b. Steel framing and supports for overhead doors.
 - c. Miscellaneous framing at other locations shown on the drawings.
5. Ladders:
 - a. Steel ladders to all roof levels, galvanized and shop primed at exterior locations.
 - b. Steel ladders at interior locations, shop-primed.
 - c. Steel ladder safety cages, galvanized at exterior locations.
 - d. Ship's ladder.
 - e. Steel elevator pit ladder, shop primed.
6. Preassembled steel stairs with metal pan treads, shop primed
7. Shop-primed steel guardrails with stainless steel wire mesh panels for interior locations.
8. Shop-primed and shop finished galvanized exterior railings.
9. Aluminum grating and frames for catwalk and elevator sump pit.
10. Stainless steel handrails all locations.
11. Aluminum custom exterior building signage.
12. Aluminum gate and framing.
13. Galvanized and shop-primed steel downspout guards.
14. Cast iron downspout boots.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
- E. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

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. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304 at interior, Type 316L at exterior.
- E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304 at interior, Type 316L at exterior.

- F. Woven-Wire Mesh, Stainless Steel: Intermediate-crimp, square pattern, 2-inch woven-wire mesh, made from 0.12-inch nominal diameter wire, stainless steel Type 304, complying with ASTM A 555 and ASTM A 580.

2.4 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.

2.5 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.
 - 1. Aluminum Components: Type 316 stainless-steel fasteners.
 - 2. Stainless-Steel Components: Type 316 stainless-steel fasteners.
 - 3. Dissimilar Metals: Type 316 stainless-steel fasteners.
- 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.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

- D. 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.

2.7 MISCELLANEOUS METALS 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.

2.8 METAL STAIR AND METAL RAILING FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.

- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work 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 Stair: Type 1.
- I. Fabricate joints that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

2.9 STEEL PIPE RAILINGS

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of pipe, post spacings, and anchorage, but not less than that needed to withstand indicated loads. Refer to "Ferrous Metal" article hereinabove for weight designations.
- 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 wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 1. Connect posts to stair framing by direct welding, unless otherwise indicated.
 - 2. For 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.
- I. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- J. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless exposed fasteners are the standard fastening method for railings indicated.

2.10 STAINLESS STEEL HANDRAILS AND BRACKETS

- A. Comply with requirements as specified hereinabove for steel railings.
- B. Stainless Steel Railings and Brackets: Provide stainless steel railings and brackets with No. 4 satin finish.
 - 1. Stainless-Steel Ornamental Railings:
 - a. Blum, Julius & Co., Inc.
 - b. Blumcraft of Pittsburgh.
 - c. Livers Bronze Co.
 - d. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.11 ALUMINUM GATE

- A. Provide custom fabricated aluminum gate, anchors, hardware (including locking mechanism), and other components as required for a complete fully functioning swinging gate assembly.
- B. Infill Panels: Provide perforated aluminum panels as specified herein above for guardrails.

2.12 ALUMINUM EXTERIOR BUILDING SIGNAGE

- A. Provide custom fabricated reverse halo lit aluminum exterior building signage with returns including concealed anchors, and support framing as indicated on drawings.
- B. Provide custom graphics as indicated on drawings.
- C. Coordinate connection of lighting with electrical contractor.
- D. Stand-offs: 4" deep, stainless steel.
- E. Finish:
 - 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 2. Finish system for all aluminum components shall be factory applied after proper preparation. Thoroughly clean all surfaces; remove all blemishes, dents, abrasions, scratches, and tool marks from surfaces which will be exposed to view.
 - 3. Exterior Finish of all exposed aluminum furnished under this Section, shall be "Kynar 500", "Duranar XL", "Fluoropon", or equal as approved. Provide a 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, and fluoropolymer topcoat, with 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. Custom colors shall be selected by Architect. Minimum dry film thickness: 1.5 mils.

2.13 STEEL-FRAMED STAIRS

- A. Available Manufacturers:
 - 1. Alfab, Inc.
 - 2. American Stair, Inc.
 - 3. Sharon Companies Ltd. (The).
 - 4. Or Equal.
- B. Stair Framing:
 - 1. Fabricate stringers of steel tubes. Provide closures for exposed ends of stringers.
 - 2. Construct platforms of steel tube 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 stair enclosure.
- 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 subreads 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 subreads. Weld subplatforms to platform framing.

2.14 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 including mechanical penetrations in masonry walls. 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.

2.15 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports as scheduled in Article 2.1, as shown on the Drawings, and 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.

2.16 METAL LADDERS

- A. General:
 1. Comply with ANSI A14.3, unless otherwise indicated.
 2. For elevator pit ladder, 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.

2.17 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.

2.18 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.

2.19 METAL BAR GRATINGS

A. Manufacturers:

- 1. Acceptable Manufacturers include Ohio Gratings Inc. 5299 Southway St. SW, Canton, Ohio 44706, 800-321-9800 www.ohiogratings.com, or approved equal.
 - a. Basis of Design Model: 11-SG-4 by Ohio Gratings, Inc.

B. Manufactured Units:

- 1. Provide aluminum Flush Top Swage Lock Grating type 11-SGF-4: Fabricated by assembled square cross bars through diamond shaped hole in rectangular bearing bars and permanently locked in place by swaging.
 - a. Bearing Bar Spacing: 11/16" on center.
 - b. Bearing Bar Depth: 1-1/4 inches, unless indicated otherwise.
 - c. Bearing Bar Thickness: 3/16" to provide 1/2" space between bars.
 - d. Cross Bar Spacing: 4" on center.
- 2. Fabrication: Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings. Band ends and cuts in grating with bars of same size and material as bearing bars.
- 3. Design Criteria:
 - a. Loading: Grating Products shall be designed and manufactured to meet the live load conditions of 100 lbs/ Sq Ft with maximum deflection of 1/4" for the clear spans shown on the drawings. Bearing bar depth shall be as shown on the contract drawings or as recommended by the manufacturer to meet the loading requirements, clear span conditions and maximum deflections specified.
 - b. Slip Resistance: Walking Surfaces shall have a minimum slip resistant coefficient of friction (COF) of 0.8 to meet Americans with Disabilities Act (ADA) guidelines of COF = 0.6 for level surfaces and 0.8 for ramps

C. Materials: Bearing bars and banding are Aluminum Type 6063-T6 and Aluminum Cross Bars are type 6063-T1.

D. Fabrication Tolerances shall be in accordance with ANSI/NAAMM MBG 531-09 Metal Bar Grating Manual.

E. Finish: Gratings shall be Clear Anodized

F. Accessories: Provide appropriate fasteners for type, grade, and class required for the approved anchorage system.

2.20 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 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.

- B. Elevator Pit: Cover shall be supported on a continuous perimeter galvanized steel angle frame anchored into the concrete walls of the pit such that the grate cover is flush to the surface of the pit.

2.21 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.

2.22 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.

- C. Downspout Guards: Provide galvanized and shop-primed, fabricated downspout guards from 3/8-inch- (9.5-mm-) thick by hot – dipped galvanized steel plate, bent to fit around downspout with 2-inch (50- mm) clearance between downspout and downspout guard, and with flanges for wall mounting. Provide stainless steel type 316 masonry wall anchors. Provide guards at all locations where downspouts come down to grade.

2.23 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.

2.24 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-SP3, "Power Tool 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. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd grey primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. 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 standards when calculated according to 40 CFR 59, Subpart D (EPA Method 24). Provide Tnemec Series 394 Primerprime at 3.0 mils DFT or approved equal by DuPont or Carboline.
- D. 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. Comply with ASTM A 123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards. The galvanizing bath shall contain high grade zinc and other earthly materials. Fill vent holes and grind smooth after galvanizing.
- E. Hot-Dip Galvanizing And Factory-Applied Primer for Steel: Provide hot-dip galvanizing and 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 galvanizer's plant in a controlled environment meeting applicable environmental regulations and as recommended by the primer coating manufacturer. 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:
1. Basis of Design: Primergalv by Duncan Galvanizing, or approved equal.
 2. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load); 1kg Load: 200 mg loss.
 3. Adhesion per ASTM D4541: 1050 psi.
 4. Corrosion Weathering per ASTM D5894, 13 cycles, 4,368 hours: Rating 10 per ASTM D714 for blistering; Rating: 7 per ASTM D610 for rusting.
 5. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
 6. Flexibility per ASTM D522, 180° Bend, 1 inch Mandrel: Passes.
 7. Pencil Hardness per ASTM D3363: 3H.
 8. Moisture Condensation Resistance per ASTM D4585, 100° F, 2000 hours: Passes, no cracking or delamination
 9. Dry Heat Resistance per ASTM D2485: 250° F.
- 2.25 HOT-DIP GALVANIZING AND FACTORY-APPLIED ARCHITECTURAL FINISH
- 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 earthly materials.

5. Fill vent holes after galvanizing, if applicable, and grind smooth.
- B. 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: Colorgalv by Duncan Galvanizing.
 2. Primer coat shall be factory-applied polyamide epoxy primer. 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.
 3. Finish coat shall be factory-applied color-pigmented architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment meeting applicable environmental regulations and as recommended by the finish coating manufacturer. Finish 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.
 4. Coatings shall be certified OTC/VOC compliant and conform to applicable regulations and EPA standards.
 5. Apply the galvanizing, primer, and coating within the same facility and provide single-source responsibility for galvanizing, priming and finish coating.
 6. Clean galvanized surface to create an acceptable profile for coatings. Galvanizer shall certify that performance will be met without blast cleaning and coating will be applied within 12 hours of galvanizing at the galvanizer's plant. If blasted, galvanizer shall certify that rugosity standards are met.
 7. Primer shall meet or exceed the following performance criteria:
 - a. Abrasion Resistance per ASTM D 4060 (CS17 Wheel, 1,000 grams load), 1kg Load: 200 mg loss.
 - b. Adhesion per ASTM D4541: 1050 psi.
 - c. Corrosion Weathering per ASTM D5894, 13 Cycles, 4,368 Hours: Rating 10 per ASTM D714 for blistering; Rating 7 per ASTM D610 for rusting.
 - d. Direct Impact Resistance per ASTM D2794: 160 in. lbs.
 - e. Flexibility per ASTM D522, 180° Bend, 1 in. Mandrel: Passes.
 - f. Pencil Hardness per ASTM D3363: 3B.
 - g. Moisture Condensation Resistance per ASTM D4585, 100° F, 2000 Hours: Passes, no cracking or delamination.
 - h. Dry Heat Resistance per ASTM D2485: 250° F.
 8. Topcoat shall meet or exceed the following performance criteria:
 - a. Abrasion Resistance per ASTM D 4060, CS17 Wheel, 1,000 Cycles 1kg Load: 87.1 mg loss.
 - b. Adhesion per ASTM D 4541: 1050 psi.
 - c. Direct Impact Resistance per ASTM D2794: >28 in. pounds.
 - d. Indirect Impact Resistance per ASTM D2794: 12-14 in. pounds.
 - e. Dry Heat Resistance per ASTM D2485: 200° F.
 - f. Salt Fog Resistance per ASTM B 117 9,000 Hours: Rating 10 per ASTM D714 for blistering.
 - g. Flexibility per ASTM D522, 180° Bend, 1/8 in. Mandrel: Passes.
 - h. Pencil Hardness per ASTM D3363: 2H.
 - i. Moisture Condensation Resistance per ASTM D4585, 100° F, 1000 Hours: No blistering or delamination Xenon Arc Test per ASTM D 4798: Pass 300 hours

2.26 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. 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.

2.27 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform 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.
- 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. 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 aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.
- G. Concrete fill for treads and platforms shall be performed under Section 033000 - CAST-IN-PLACE CONCRETE.

3.2 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.

3.3 INSTALLING STEEL PIPE 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. Refer to architectural drawings for handrail details.
 - 3. Set posts in concrete as shown on drawings.
- 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.

3.4 INSTALLING METAL GRATINGS

- A. Prior to grating installation, contractor shall inspect supports for correct alignment and conditions for proper attachment and support of the gratings. Any inconsistencies between contract drawings and supporting structure deemed detrimental to grating placement shall be reported in writing to the architect or owner's agent prior to placement.
- B. Install grating in accordance with shop drawings and standard installation clearances as recommended by ANSI/NAAMM MBG-531-09 Metal Bar Grating Manual.
- C. Protection of Aluminum from Dissimilar Materials:
 - 1. Where aluminum surfaces come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with one coat of bituminous paint or use of other approved insulating material.

2. Where aluminum surfaces come into contact with dissimilar materials such as concrete, masonry or lime mortar, exposed aluminum surfaces shall be painted with one coat of bituminous paint or use of other approved insulating material.

- D. Grating Attachment: Use approved attachment system and fasteners to secure grating to supporting members as shown on plans.

3.5 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 057300

DECORATIVE GLASS RAILINGS

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 the following:
 - 1. Glass-supported railings.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 055000 – METAL FABRICATIONS for steel stairs, handrails, and guardrails.
 - 2. Section 061000 - ROUGH CARPENTRY for wood blocking for anchoring railings.
 - 3. Section 092900 - GYPSUM BOARD ASSEMBLIES for metal backing for anchoring railings.

1.3 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
 - 1. Glass: 25 percent of mean modulus of rupture (50 percent probability of breakage), as listed in "Mechanical Properties" in AAMA's Aluminum Curtain Wall Series No. 12, "Structural Properties of Glass."
- 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.
 - 1. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

- D. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Manufacturer's product lines of railings assembled from standard components.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of metal railings; fabrication; and fastening and anchorage details, including mechanical fasteners. Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For railing 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.
- D. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
 - 2. Each type of glass required.
 - 3. Fittings and brackets.
 - 4. Welded connections.
 - 5. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.
- E. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For professional engineer.

1.6 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 metal railings that are similar to those indicated for this Project in material, design, and extent.
- C. Installer Qualifications: Fabricator of products.
- D. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- E. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.2, "Structural Welding Code--Aluminum."
 - 2. AWS D1.6, "Structural Welding Code--Stainless Steel."
- F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Glass-Supported Railings:

- a. Blum, Julius & Co., Inc.
- b. Blumcraft, A Division of C.R. Laurence Co., Inc.
- c. HDI Railing Systems.
- d. Livers Bronze Co.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails, unless otherwise indicated.
 1. Provide cast-metal brackets with flange tapped for concealed anchorage to threaded hanger bolt.
 2. Provide either formed- or cast-metal brackets with predrilled hole for exposed bolt anchorage.
 3. Provide extruded-aluminum brackets with interlocking pieces that conceal anchorage. Locate set screws on bottom of bracket.

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.
- E. Wire Rope: 1 x 19 wire rope made from wire complying with ASTM A 492, Type 316.
- F. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

2.4 GLASS AND GLAZING MATERIALS

- A. Glass: Provide as specified in Section 088000 - GLAZING.

2.5 FASTENERS

- A. General: Provide the following:
 1. Aluminum Components: Type 316 stainless-steel fasteners.
 2. Stainless-Steel Components: Type 316 stainless-steel fasteners.
 3. Dissimilar Metals: Type 316 stainless-steel fasteners.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work, unless exposed fasteners are the standard fastening method for railings indicated.
- D. Anchors: Provide anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.6 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- C. 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.

2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Form changes in direction as detailed on the Drawings and as standard with system selected.
- H. Comply with "Guideline 1: Joint Finishes", by National Ornamental & Miscellaneous Metals Association (NOMMA), as follows:
 - 1. Ornamental Railing: Type 1.

- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- J. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

2.8 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
- B. Structural Glass Balusters: Factory-bond glass to aluminum base and top-rail channels in railing manufacturer's plant using glazing cement to comply with manufacturer's written specifications, unless field glazing is standard with manufacturer.
- C. Apply ceramic linework on glass to comply with GANA's "Engineering Standards Manual."

2.9 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 shipment.
- 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 same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform 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.
- 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 plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum and copper alloys that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 INSTALLING GLASS PANELS

- A. Glass-Supported Railings: Install assembly to comply with railing manufacturer's written instructions.
 - 1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels.
 - a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - 2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
 - 3. Erect glass railings under direct supervision of manufacturer's authorized technical personnel.

3.4 CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.
- B. Clean and polish glass.

3.5 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

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.
- 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 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.
 - 3. Plywood subflooring and substrate panels where indicated.
 - 4. Raised platforms and steps where indicated.
 - 5. Plywood sheathing at sheet metal siding.
 - 6. Plywood sheathing at roof edges, roof eaves, and details.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for wood nailers and blocking built into masonry.
 - 2. Section 054000 - COLD FORMED METAL FRAMING for light gauge structural framing for support of raised steps and platforms.
 - 3. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for interior woodwork not specified in this Section.
 - 4. Section 096400 - STAGE FLOORING for Wood Flooring System at stage.
 - 5. Section 123000 - MANUFACTURED CASEWORK AND EQUIPMENT for Manufactured Casework.

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.

1.4 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.
- C. 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 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. 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.

B. Plywood Sheathing and 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: AWPAC2 (lumber) and AWPAC9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWPAC31 with inorganic boron (SBX).
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and not containing arsenate.
- B. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- 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.
 3. Plywood sheathing.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For interior use materials, described below and as indicated on the drawings. Provide materials that are fire-retardant treated and comply with performance requirements in AWPAC20 (lumber) and AWPAC27 (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.
 3. Interior Locations:

- a. Provide fire retardant treated panels and lumber at areas where they are exposed to the interior such as backer panels at electrical, mechanical, equipment support panels and subfloor applications at raised steps and platforms.
- b. The following are not required to be fire retardant treated in Type I & II construction: blocking for handrails, millwork, cabinets, interior door and interior window frames and other such blocking concealed behind gypsum wall panels for wall mounted elements.

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.
 1. Sheathing at roof details: 1/2".
 2. Sheathing at metal siding: 3/4".
- 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.
- C. Plywood subflooring for tiered and stepped seating shall be 3/4 inch thick T&G.

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. Miscellaneous Framing: Provide hat channels as indicated in drawings and in accordance with requirements of section 054000 – COLD-FORMED METAL FRAMING.
- B. 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 AWWA 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. Predrill 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.
 - 1. Provide blocking within walls at the following locations: Toilet accessories, markerboards tackboards, handrail brackets, wall mounted light fixtures, wall mounted door stops, wall mounted technology equipment, white boards, wall mounted projectors, and other locations where items will be mounted to wall surfaces.
- 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.
- 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 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-mat gypsum sheathing attached to cold-formed metal framing members at exterior wall.

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

- 1. Section 042000 - UNIT MASONRY for masonry-veneer anchors 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 072500 - AIR BARRIERS for joint sealant required at exterior sheathing & air/vapor membrane system 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.

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. Type and Thickness:
 - a. Regular 1/2" inch thick at non-fire rated locations.
 - b. Type X, 5/8 inch thick, where fire rated sheathing is indicated on the drawings.
 - 2. Size: 48 by 96 inches.
 - 3. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to:
 - a. Georgia-Pacific Gypsum LLC; Dens-Glass.
 - b. National Gypsum Company; Gold Bond, eXP Extended Exposure Sheathing.
 - c. USG Corporation; Securock.

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.
 - 2. Screw Head and Joint Treatment: Substrate patching sealant shall be provided under section 072500-AIR BARRIERS.

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. Conform to the requirements of air vapor barrier and sheet waterproofing manufacturer's recommendations regarding the sheathing joint tolerances prior to installation.
- C. Coordinate sheathing installation with air vapor barrier and sheet waterproofing 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, deflection joints or control joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Horizontal Installation: Install gypsum sheathing boards horizontally with vertical edges centered over flanges of steel studs and stagger end joints of adjacent boards not less than one stud spacing. 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.
- G. Screw Head and Joint Treatment: Substrate patching sealant shall be provided under section 072500 AIR BARRIER. .

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.
- 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 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 wood base.
 - 2. Flush wood paneling.
 - 3. Wood panel reflector clouds.
 - 4. Custom wood cabinets.
 - 5. Custom wood mailbox cubbies.
 - 6. Custom wood casework.
 - 7. Custom wood platform stairs and strip flooring.
 - 8. Display cases.
 - 9. Sliding glass hardware for display cases.
 - 10. Administration/CTC Administration, Security, and Library custom desks.
 - 11. Custom wood benches.
 - 12. Window stools, plastic laminate with solid wood edges.
 - 13. Closet shelving.
 - 14. Wood caps for low walls.
 - 15. Solid wood edging and frames for acoustic wall panels and tackboards.
 - 16. Custom steel supports for interior woodwork including but not limited to counter support brackets.
 - 17. Shop finishing of interior woodwork.
- B. 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. Section 088000 - GLAZING for display case glass doors and shelves.
 - 3. 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. 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.
- C. Samples for Initial Selection: Provide a minimum of 12 (3" x 3") stain samples on specified wood for initial selection by Architect.
- 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.
- E. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates for both the fabricator and installer.
- F. Qualification Data: For Installer and fabricator.
- G. IAQ Submittals: For each product that contains VOC's, comply with submittal requirements specified in Section 018119 – Indoor Air Quality Requirements.

1.4 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.
- C. 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.
1. Project References: Provide at least 3 references for 3 similar projects.
- 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. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- C. Wood Species and Cut for Transparent Finish: Select White Maple, Quarter Sawn; with up to two stains for each location.

- D. 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.
- E. 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. Wilsonart International, LLC.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Nevamar Company, LLC; Decorative Products Div.
- F. Material used as interior trim shall have minimum Class C flame spread and smoke-developed indexes.

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.
- 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, 5/8 inch wide; Knape & Vogt, 87SS Standard, 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; Knape & Vogt, 186 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; Knape & Vogt, 187 Shelf Bracket with Anochrome Finish, or equal.
- F. Drawer Slides: 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. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.
 - 1. Track Assembly: Provide all components required for complete installation of sliding 1/4" glass doors; assembly shall be rated to support 30 pounds per door; Knape & Vogt, P1092 ANOD Ezy-Roll Aluminum Track Assembly, or equal.
 - 2. Components of assembly: Provide quantities as required for conditions shown on Drawings.
 - a. Upper channel: Double channel to guide top of sliding doors, 1-3/16 inch wide by 9/16 inch high; Knape & Vogt, 1093, or equal.
 - b. Lower track: Double track with center rail to guide rollers; Knape & Vogt, 1099, or equal.

- c. Vinyl guides: 7/8 inch long vinyl guide to fit over top edge of glass for noiseless operation in upper channel; Knappe & Vogt, 1085, or equal.
 - d. Shoe: 1 inch high vinyl shoe to fit on bottom edge of glass for attachment of rollers; Knappe & Vogt, 1095, or equal.
 - e. Nylon rollers: Knappe & Vogt, 1097 NYLON, or equal.
 - H. 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.
 - I. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
 - J. 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.
 - K. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
 - L. Chain stops: Provide chain door stops for all cabinet doors as required to prevent doors from coming in contact with adjacent construction.
 - M. Name Plates: Provide metal name plates with interchangeable name slots at mailboxes, one for each cubby.
- 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: 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.
- 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.
1. Basis of Design: Provide Rakks EH Series, or approved equal.
 2. Finish: Manufacturer's standard powder coated finish in color as selected by Architect.
- G. Provide joint sealants in accordance with requirements of Section 079200 – JOINT SEALANTS at locations indicated herein below in Part 3.

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.

2.6 INTERIOR STANDING AND RUNNING TRIM, BASE, WINDOW STOOLS FOR TRANSPARENT FINISH

- A. Grade: AA, 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.
- 2.7 FLUSH WOOD PANELING
- A. Grade: AA, Premium.
 - B. Wood Species and Cut: Select White Maple, Quarter Sawn.
 - C. Matching of Adjacent Veneer Leaves: Slip match.
 - D. Veneer Matching within Panel Face: Center-balance match.
 - E. Panel-Matching Method: Match panels within each separate area by the following method:
 1. Premanufactured sets for full width.
 - F. Vertical Panel-Matching Method: Continuous match.
 - G. Fire-Retardant-Treated Paneling: Provide panels consisting of wood veneer and fire-retardant particleboard or fire-retardant medium-density fiberboard. Panels shall have flame-spread index of 25 or less and smoke-developed index of 450 or less per ASTM E 84.
 - H. Stains: Provide up to 2 colors for each area as selected by Architect.
- 2.8 CUSTOM WOODWORK AND CABINETS FOR TRANSPARENT FINISH
- A. Grade: AA, Premium.
 - B. AWI Type of Cabinet Construction: As indicated.
 - C. Reveal Dimension: As indicated.
 - D. Wood Species and Cut for Transparent Finish: White maple, select Quarter Sawn.
 1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
 2. Matching of Veneer Leaves: Book match.
 3. Vertical Matching of Veneer Leaves: End match.
 4. Veneer Matching within Panel Face: Center-balance match.
 5. Veneer Matching within Room: Provide cabinet veneers in each room or other space

from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.

6. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.

E. Semiexposed Surfaces: Provide surface materials indicated below:

1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
2. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
3. Drawer Bottoms: Hardwood plywood

F. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.9 PLASTIC-LAMINATE WINDOW STOOLS WITH SOLID WOOD EDGES

- 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: Solid wood to match casework and as detailed on Drawings.
- E. Core Material: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

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 WOOD STRIP FLOORING AT PLATFORM

- A. Match wood strip flooring as specified in Section 096460 – WOOD ATHLETIC FLOORING. Resilient pads are not required.

2.12 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 Architect's 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: [Satin, 30-50 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. Wood Strip Flooring: Install wood strip flooring in accordance with requirements of section 096460 – WOOD ATHLETIC FLOORING.
- I. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening.
 - 1. Install flush paneling with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
- J. 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.
- K. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Align adjacent countertops. 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. Caulk space between backsplash and wall with sealant specified in Section 079200 - JOINT SEALANTS.

- L. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- M. 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.
- N. Coordinate installation of sealants to allow final Painting of installed sealants by SECTION 099000 to occur in sequence with Final Painting of adjacent surfaces.
- O. Coordinate installation of sealants to allow final Painting by SECTION 0990000 to occur in sequence with Final Painting of adjacent surfaces.

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

FRP 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. 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.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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 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 071100

BITUMINOUS DAMPPROOFING

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 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. Mastic coating for steel that is below grade and /or is in contact with concrete.
 - c. Mastic coating for steel elements which penetrate through the air/vapor barrier envelope within the masonry veneer or metal wall panel cavity.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 311000 – EARTHWORK, for backfilling following application of dampproofing and mastic.
 - 2. Section 033000 – CAST-IN-PLACE CONCRETE, concrete substrate conditions & finish walls & footings to receive dampproofing.
 - 3. Section 051200 - STRUCTURAL STEEL FRAMING, steel substrate for mastic coatings.

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. Material Certificates: For each product, signed by manufacturers.
- C. Compatibility Statement:
 - 1. Waterproofing and Dampproofing System: Provide written documentation from manufacturers of each specified system indicating that all components are compatible with one another.

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 BITUMINOUS DAMPPROOFING

- A. Cold-Applied, Emulsified-Asphalt Dampproofing, Brush and Spray Coats: ASTM D 1227, Type II, Class I.
- 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. Karnak, *920AF Fibered Emulsion Mastic (Trowel Grade)*
 - 2. W. R. Meadows, *Sealmastic Emulsion, Type III – Trowel-On Grade*
 - 3. BASF, MasterSeal 615.

2.2 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.

2.3 MASTIC COATING FOR STEEL

- A. Mastic: Fluid-applied fibered emulsion mastic comprising clay emulsifiers, refined asphalt products and non-asbestos fibers, to form a durable, moisture-resistant coating, in conformance with ASTM D-1187, Type II and D-1226, Type II, Class 1.
- B. Locations:

1. Provide coating over lintels and structural steel in contact with soil, concrete or exterior masonry.
2. Provide coating over steel elements which penetrate through the air/vapor barrier envelope within the masonry veneer or metal wall panel cavity.

C. Product:

1. Karnak, *220 AF Semi-Mastic*
2. Sonneborn, *Hydrocide Semi-Mastic*
3. Approved equal.

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. Locations:

1. Apply dampproofing to footings and foundation walls below grade where waterproofing is not required, and where shown on Drawings or otherwise indicated.
2. Apply mastic coating to steel at all locations where steel is below grade, over steel elements which penetrate through the air/vapor barrier envelope within the masonry veneer or metal wall panel cavity, and where shown on the Drawings.
 - a. Where mastic is required and will be in contact with the air barrier, coordinate sequencing and compatibility of materials prior to installation.

C. 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.

D. 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

FLUID APPLIED WATERPROOFING

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 DESCRIPTION OF WORK

- A. Provide spray-applied fluid waterproofing at brick shelves as indicated on Drawings.
- B. Provide spray-applied fluid waterproofing and drainage-protection boards at below grade applications at foundation walls as indicated on Drawings.
- C. Provide spray applied fluid waterproofing @ steel columns encased by masonry or metal column covers at exterior locations as indicated on the drawings.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 033000, CAST-IN-PLACE CONCRETE for concrete substrate.
 - 2. Section 051200, STRUCTURAL STEEL FRAMING

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used.
- B. 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. Shop drawings shall be drawn at no less than 6"-1'-0" scale.
- C. Samples: For the following products:
 - 1. 12-by-12-inch square of waterproofing and flashing sheet.
 - 2. 4-by-4-inch square of drainage-insulation 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.
- G. Substrate Acceptability: Submit a certified statement issued by the manufacturer of the waterproofing materials and countersigned by the installer, attesting that all areas and surfaces designated to receive waterproofing and flashing have been inspected and found satisfactory for the reception of the Work covered under this Section. Application of materials will be construed as acceptance of surfaces.
- H. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.
- B. Installer Qualifications: A firm with a minimum of three years experience in the application of waterproofing and certified by the manufacturer of the fluid-applied waterproofing.
- C. Waterproofing Mock-Up: Provide a mock-up of waterproofing applied at one wall for approval. Mock-up shall serve as the basis for acceptability of subsequent work. Mock-up shall include preparation of substrate and coordination with flashing and subsequent work. Remove and replace mock-ups which are not acceptable at no additional expense to the Owner.
- D. 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 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's unopened containers fully identified with brand, type, grade, date of manufacture, and other qualifying information.
- B. Store materials in original tightly sealed containers or unopened packages. Store materials out of weather, above ground, in dry area, and in compliance with manufacturer's maximum storage temperature range.

1.7 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 insulation.

PART 2 - PRODUCTS

2.1 FLUID APPLIED WATERPROOFING

- A. Fluid Applied Waterproofing: Provide the following system, or approved equal by Carlisle Coatings & Waterproofing or Henry Company.

1. Fluid applied (vertical) waterproofing shall be spray-applied Tremproof 260 by Tremco Inc. Fluid applied (vertical or horizontal surfaces) provide Tremproof 250GC for roller grade.

- a. Physical Properties: Polymer-enhanced, single-component, fluid-applied asphalt emulsion waterproofing membrane:

<u>Property</u>	<u>Test Method</u>	<u>Typical Value</u>
Color		black
Cured Film Thickness		60 mils minimum
Solids Content		60%
Crack Bridging Ability	ASTM C 836	Passes
Elongation	ASTM D 412	800% minimum
Peel Adhesion to Concrete	ASTM C 836	Exceeds

- b. Drainage-Insulation- Protection Board: Provide Tremdrain DPI Drainage-Insulation and Protection Board; thickness as shown on the drawings, by Tremco Inc., or approved equal.
 - c. Primers, Flashings, and Accessories: Provide waterproofing manufacturer recommended primers, flashings, and accessories for a complete waterproofing assembly.

- B. Metal Termination Bars: Stainless steel bars, approximately 1 by 1/8 inch thick, predrilled at 8" on center minimum or to match spacing of structural support member where required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The installer shall examine conditions of substrates and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

3.2 PREPARATION OF SUBSTRATES

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to manufacturer of the fluid applied waterproofing.

- B. Related Materials: Treat joints and install flashing as recommended by waterproofing manufacturer.

3.3 INSTALLATION

1. Spray apply fluid applied waterproofing in accordance with manufacturer's recommendations and the following:
2. If area to be waterproofed is in direct sunlight and temperature is rising, apply "scratch coat" (a thin application of fluid applied waterproofing) prior to the full application of the waterproofing membrane.
3. In applications where a minimum slope of 11 mm/m (0.13 in./ft) can not be achieved, a two coat application of product is recommended.
4. Trowel apply waterproofing to spot patch masonry anchors penetrating waterproofing.
5. Install the drainage-insulation-protection board to the spray-applied waterproofing before it has cured. No mastics or adhesives are necessary to hold the board in place. Begin by placing the board at the footer or lowest installation point and progress up the wall. Successive boards shall be placed by standing them on top of the previous board. Joints between boards shall be tightly fit without gaps.

3.4 WATER TESTING

- A. All horizontal areas shall be water tested.
- B. Do not water test within 48 hours after application of waterproofing or until waterproofing is fully cured.
- C. Water testing shall include flooding of entire area of work to a minimum depth of 2 in. above high points in its entirety for a minimum period of 24 hours.
- D. In any areas where leaks occur, area shall be drained, thoroughly dried, repaired, and then retested as above.
- E. Contractor and waterproofing manufacturer shall verify that portion of area tested has not shown any evidence of leakage by jointly signing a Drawing which indicates areas tested.

3.5 CLEANING AND PROTECTION

- A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
- B. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.

END OF SECTION

SECTION 071600

POLYMER MODIFIED CEMENT WATERPROOFING

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 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. Negative side, modified cement waterproofing for the following applications:
 - a. Elevator pits (includes walls and floors from grade line to bottom of the pit)
 - b. Sump pits.
- B. Related Work: The following items are not included in this Section and will be performed 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 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 modified cement waterproofing.

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 modified cement 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 modified cement 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.
 - b. Bond failure.
 - 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. Negative-Side, Prepackaged, Modified Cement Waterproofing:
 - a. AQUAFIN, Inc.; Aquafin-1K.
 - b. BASF Building Systems; Thoroseal.
 - c. ChemMasters; ChemSeal.
 - d. Euclid Chemical; Tamoseal.
 - e. Five Star Products, Inc.; Five Star Waterproofing.

2.2 MATERIALS

- A. Modified Portland Cement-Based Waterproofing: Manufacturer's standard polymer admixture for mixing with the following materials to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, and resists negative side hydrostatic pressure:
 - 1. Portland Cement: ASTM C 150, Type I.
 - 2. Trowel-Coat Aggregate: ASTM C 33, fine aggregate.
- B. Prepackaged, Modified Cement Waterproofing: Manufacturer's proprietary blend of dry cementitious and other ingredients for mixing with water to produce a waterproof coating that is suitable for vertical and horizontal applications below or above grade, is breathable, and resists negative hydrostatic pressure.

1. Properties of Cured Waterproofing:
 - a. Permeability: 0 for water at 30 feet when tested according to CE CRD-C 48.
 - b. Compressive Strength: Minimum 3600 psi at 28 days when tested according to ASTM C 109/C 109M.
 - c. Flexural Strength: Minimum 725 psi at 28 days when tested according to ASTM C 348.
 - d. Bond Strength: 300 psi at 14 days when tested according to ASTM C 321.
 - C. 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.
 - D. 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.
- 2.3 PROPORTION AND DESIGN OF MIXES
- A. Prepackaged, Modified Cement Waterproofing:
1. Add prepackaged dry ingredients to mixing liquid according to manufacturer's written instructions. Mix together with mechanical mixer or by hand to required consistency.

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 modified cement 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, paint, 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.
 - 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. Apply first bond coat as a slurry with brush or stiff broom, and subsequent coats with brush, spray, or trowel to specified surface finish. Dampen surface between coats.
 - 3. Total Thickness: Two 1/16 inch coats, total 1/8 inch total thickness.
- B. Final Coat Finish: Smooth troweled.
- C. Curing: Air-cure waterproofing.
- 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, modified cement waterproofing from rapid drying, severe weather exposure, and water accumulation. Maintain completed Work in moist condition for not less than seven days by covering with impervious sheeting or by other curing procedures recommended in writing by waterproofing manufacturer.

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 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 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. Mineral wool semi-rigid insulation board and rigid thermal insulation at exterior walls.
 - 2. Mineral wool semi-rigid insulation board at roofs under roof top equipment.
 - 3. Mineral wool semi-rigid insulation board.
 - 4. Underslab and Foundation Rigid Insulation and Vapor Retarder.
 - 5. Compressible insulation joint filler.
 - 6. Spray foam joint sealant and insulation at joints and gaps.
- B. This Section includes requirements for insulation for the following applications, provided under other Sections where insulation requirements are specified by reference to this Section:
 - 1. Requirements for rigid thermal insulation and vapor barrier for underslab and foundation locations provided under Section 033000 – CAST-IN-PLACE CONCRETE.
 - 2. Rigid insulation at base wall flashing, provided under Section 042000 – UNIT MASONRY.
- C. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections:
 - 1. Rigid thermal insulation behind masonry veneer, installed under Section 042000 – UNIT MASONRY.
- D. Related Sections include the following:
 - 1. Section 033000 – CAST-IN-PLACE CONCRETE, for slabs on grade and foundation walls where rigid thermal insulation will be installed.
 - 2. Section 042000 – UNIT MASONRY, for insulation-retaining brick ties and related masonry work.
 - 3. Section 064020 – INTERIOR ARCHITECTURAL WOODWORK, for cabinet construction

requiring foil-faced, rigid-glass fiber insulation.

4. Section 078400 – FIRESTOPPING, for insulation used as part of firestopping systems.
5. Section 092900 – GYPSUM BOARD, for acoustical insulation.
6. Section 071300- FLUID APPLIED WATERPROOFING for insulation materials to be used at vertical below grade foundation walls where waterproofing is required.
7. Section 123000 – MANUFACTURED CASEWORK, for cabinet construction requiring foil-faced, rigid-glass fiber insulation.

1.3 INDOOR AIR QUALITY REQUIREMENTS

- A. Volatile Organic Compounds: All products specified in this section shall comply with the following limits on content of VOC's:
 1. Sealant: Maximum 250 grams/liter total VOC's
- B. Formaldehyde: No product specified in this section shall contain added urea-formaldehyde resins. Total formaldehyde content shall not exceed ANSI A208.1-1993 emission standard of 0.20 ppm of formaldehyde.
- C. No sealant specified in this section for interior installation shall contain aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium or hexavalent chromium.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: Full-size units for each type of insulation and vapor retarder indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.
- D. Research/Evaluation Reports: For foam-plastic insulation.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related 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 materials with appropriate markings of applicable testing and inspecting agency.
 1. Surface-Burning Characteristics: ASTM E 84.
 2. Fire-Resistance Ratings: ASTM E 119.
 3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect 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 plastic insulating materials to Project site before installation time.
 - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
 - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Unfaced, Mineral-Wool Semi-Rigid Insulation Board for **[masonry veneer exterior walls and metal-sided vented rain screen exterior walls]**: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 5 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Nominal density of 4.5 lb/cu. ft.
 - 2. Thermal Resistivity: Greater than or equal to R-4.2 per inch.
 - 3. Size: 3" thick x 16" wide x 48" or 60" long.
 - 4. Recycled Content: Minimum 45 percent.
 - 5. Product:
 - a. Owens Corning, Thermafiber RainBarrier 45 (basis of design).
 - b. Roxul, Cavity Rock DD.
 - c. Approved equal.
 - 6. Accessories:
 - a. Retention pins & washers recommended by manufacturer.
 - b. Insulating Retaining Insert: Provided under Section 042000.
- C. Rigid Thermal Insulation for **[masonry veneer exterior cavity walls at base flashing conditions]**: Extruded-Polystyrene Board Insulation; ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 15 and 175, respectively:
 - 1. Type IV.
 - 2. Water Vapor Permeance: Less than or equal to 1.5 Perm for 1-inch thickness.
 - 3. Thermal Resistivity: Greater than or equal to R-5 per inch.
 - 4. Compressive Resistance: 25.0 psi (173 kPa).
 - 5. Thickness: 3" thick typical, unless noted otherwise.

6. Edge Shape:
 - a. Square edge profile or ship-lap edge profile.
 7. Products:
 - a. Pactiv Building Products, GreenGuard 25.
 - b. Owens Corning, *Foamular 250*.
 - c. Dow Chemical Company, *Styrofoam*.
 8. Accessories:
 - a. Insulation-Retaining Fasteners and Washers: Screw fasteners with 1-1/2 inch (38 mm) diameter plastic washers.
 - b. Insulating Retaining Insert: Provided under Section 042000.
 - c. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates as recommended by insulation manufacturer.
- D. Mineral-Wool Semi-Rigid Insulation Board with rigid upper surface at roof conditions under roof top equipment: ASTM C 726; with maximum flame-spread and smoke-developed indexes of 5 and zero, respectively, per ASTM E 84; Class A.
1. Nominal density of 13.75 lbs/cu.ft. for upper layer; 10 lbs/ ft lb/cu. ft.
 2. Recycled Content: Minimum 45 percent.
 3. Thermal Resistivity: Greater than or equal to R-3.7 per inch.
 4. Size: Three layers; each layer: 3" thick x 24" wide x 48" or 60" long.
 5. Product:
 - a. Owens Corning, Thermafiber RainBarrier 45 (basis of design).
 - b. Roxul, Cavity Rock DD.
 - c. Approved equal.
- E. Rigid Thermal Insulation for Underslab and Foundation Walls Locations: Extruded-Polystyrene Board Insulation; ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indices of 15 and 175, respectively:
1. Type VI.
 2. Water Vapor Permeance: Less than or equal to 1.1 Perm for 1-inch thickness.
 3. Thermal Resistivity: Greater than or equal to R-5 per inch, for a total of R-10 for a 2-inch (51 mm) thickness.
 4. Compressive Resistance: 40.0 psi.
 5. Edge Shape: Square edge profile.
 6. Products:
 - a. Pactiv Building Products, GreenGuard 40.
 - b. Owens Corning, *Foamular 400 Square Edge*.
 - c. Dow Chemical Company, *Styrofoam High Load 40*.
- F. Compressible Insulation Joint Filler-Exterior Locations: Unfaced, Mineral-Wool Semi-Rigid Insulation Board: ASTM C 612; with maximum flame-spread and smoke-developed indexes of 0 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics
1. Nominal density of 4.4 lb/cu. ft. minimum.
 2. Thermal Resistivity: Greater than or equal to R-4.2 per inch.
 3. Recycled Content: Minimum 75 percent.
 4. Size: thickness to match adjacent insulation materials.
 5. Product: RainBarrier 45 as manufactured by Thermafiber, Roxul CavityRockMD, or approved equal.

2.2 SPRAY FOAM JOINT SEALANT AND INSULATION

- A. Spray Foam Materials, General: Provide foam sealant and insulating spray foam that is compatible with all materials with which it will come in contact.
- B. Spray Foam Joint Sealant: One-component, low-expanding polyurethane foam sealant with the following properties:
 - 1. Closed cell content: Minimum 68.5%.
 - 2. Thermal performance: R- 4.5 per 1-inch thickness.
 - 3. Fire-retardant: Self-extinguishing in the absence of flame; Flame Spread Rating less than 25; Smoke Developed Rating less than 50 when tested in accordance with ASTM E-84.
 - 4. Products:
 - a. Fomo Products, Inc: Handi-Seal Window and Door Sealant.
 - b. Todol Products Inc.: Pur Fill 1G Professional Gun Foam.
 - c. Owens Corning: ProPink One Foam Sealant.
 - d. Approved equal.
- C. Spray Foam Joint Insulation: Two-component insulating polyurethane foam sealant with the following properties:
 - 1. Closed cell content: Minimum 90%.
 - 2. Thermal performance: (Aged) R- 5.48 per 1-inch thickness.
 - 3. Fire-retardant: Self-extinguishing in the absence of flame; Flame Spread Rating less than 25; Smoke Developed Rating less than 50 when tested in accordance with ASTM E-84.
 - 4. Products:
 - a. Fomo Products, Inc: Handi-Foam Two-Component E84 Class 1 Spray Foam.
 - b. Todol Products, Inc.: Puf Fill 205 Two-Component E84 Class 1 Spray Foam.
 - c. Convenience Products: Touch'n Seal FR Two-Component Class 1 Spray Foam
 - d. Approved equal.
- D. Primer for spray foam: As recommended by manufacturer for substrate.

2.3 VAPOR RETARDER

- A. Polyethylene Vapor Retarders: ASTM E 1745, Class A, 15 mils (0.38 mm) thick, with maximum permeance rating of 0.018 perm (1.032 ng/Pa x s x sq. m).
- B. Acceptable Products Include:
 - 1. W. R. Meadows, Inc., *Perminator 15 mil Underslab Vapor-Mat*.
 - 2. Reef Industries, Inc., *Griffolyn 15 Mil Green*.
 - 3. Stego Industries, LLC, *Stego Wrap*.
 - 4. Insulation Solutions, Inc., *Viper Vaporcheck II – 15 mil*.
- C. Basis of Design: Stego Wrap Vapor Barrier by Stego Industries LLC.
- D. Accessories:
 - 1. Seam Tape:
 - a. Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.

- b. Basis-of-Design: Stego Tape by Stego Industries LLC.
- 2. Vapor Proofing Mastic:
 - a. Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96.
 - b. Basis-of-Design: Stego Mastic by Stego Industries LLC.
- 3. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.
- B. Close off openings in cavities receiving spray foam joint insulation to prevent escape of insulation. Provide bronze or stainless-steel screens (inside) where openings must be maintained for drainage or ventilation.

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 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. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. Bond units to substrate with adhesive, applied in a continuous 'S' shaped

bead on the back of the insulation board, and use insulating retaining fasteners and washers to provide permanent placement and support of units.

- B. Seal joints between closed-cell (nonbreathing) insulation units by applying spray foam sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with spray foam sealant as recommended by insulation manufacturer to achieve a continuous sealed insulation layer barrier throughout.
- C. Install insulation on concrete substrates by screw-type insulation anchors and washers. Seal joints in insulation with foam sealant.
- D. At control, deflection and expansion joints, stuff compressible insulation joint filler into voids, fill completely and ensure insulation stays in place though compression.
- E. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- F. Fit rigid insulation as tight as possible to penetrating items such as columns, conduits and pipes. Install spray joint sealant/insulation at gaps between rigid insulation and penetrating items.

3.5 INSTALLATION OF SPRAY FOAM JOINT SEALANT AND INSULATION

- A. Coordinate installation of insulation with installation of air/vapor barrier components and other items in exterior wall adjacent to foam insulation.
 - 1. Spray Foam Joint Sealant: Use one-component foam for sealing the following locations, and where indicated on Drawings:
 - a. Sealing all joints, gaps, and cracks between panels of rigid thermal insulation, above grade and underslab, except for deflection, control and expansion joints.
 - b. Sealing all joints, gaps, and cracks 2 inches wide and less in rigid thermal insulation layer, at all openings and penetrations and where shown on the Drawings or required to achieve continuous insulation barrier.
 - c. Sealing penetrations 2 inches wide and less in exterior walls and roof due to the work of Divisions 21, 22, 23, 26 and 27 to form a continuous insulation barrier.
 - 2. Spray Foam Joint Insulation: Use two-component insulating foam for sealing the following locations and where indicated on Drawings:
 - a. Sealing joints greater than 2 inches wide in rigid thermal insulation layer, at all openings and penetrations and where shown on the Drawings or required to achieve continuous insulation barrier.
 - b. Sealing penetrations greater than 2 inches wide in exterior walls and roof due to the work of Divisions 21, 22, 23, 26 and 27 to form a continuous insulation barrier.
 - c. Insulating small enclosed spaces, including flutes in metal roof deck where condition does not allow the installation of mineral wool insulation.

3.6 INSTALLATION OF VAPOR RETARDERS

- A. Under Slab Vapor Barrier: Install under full area of slab in accordance with manufacturer's recommendations. Stagger end laps, lap seams and seal with tape.
- B. Seal joints caused by columns, pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape or mastic to create an airtight seal

between penetrating objects and vapor retarders. Follow manufacturers written installation requirements.

- C. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.
- D. Provide for manufacturer's representative inspection of installation and provide manufacturer's written report of inspection and acceptance of installation as being compliant with manufacturer's requirements and to requirements of ASTM E-1643 (minimum).

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072500
AIR BARRIERS

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:
 - 1. Self-adhering, vapor-retarding, modified bituminous sheet air barriers for back-up walls constructed of sheathing & stud.
 - 2. Fluid-applied, vapor-retarding, membrane air barriers for back-up walls constructed of masonry, CMU or concrete.
 - 3. Transition strips to adjacent and penetrating materials.
- B. Related Sections include the following:
 - 1. Section 042000 – UNIT MASONRY, for embedded flashings.
 - 2. Section 071100 – BITUMINOUS DAMPPROOFING AND Section 071600 - POLYMER MODIFIED CEMENT WATERPROOFING, for below-grade waterproofing and damp-proofing materials.
 - 3. Section 072100 – THERMAL INSULATION, for vapor barrier below concrete slab on grade.
 - 4. Section 075400 – THERMOPLASTIC MEMBRANE ROOFING, for roof air barriers.
 - 5. Section 076200 – SHEET METAL ROOFING, SIDING, FLASHING AND TRIM, for sheet metal flashings.
 - 6. Section 078400 – FIRESTOPPING, for sealants required to maintain both fire-rating and air barrier in vertical shafts.
 - 7. Section 061600 – SHEATHING for exterior wall sheathings.

1.3 DEFINITIONS

- A. Air Barrier Material: The principal material installed on the wall for the purpose of controlling air infiltration through the solid wall assembly. The Air Barrier Material is specified in this Section.

- B. Air Barrier Accessory: Transitional element installed at joints and junctions between air barrier assemblies to control air movement through the air barrier system. Air Barrier Accessories are specified in this Section.
- C. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- D. Air Barrier System: The sum of air barrier assemblies that comprise a building envelope's walls, roof, and ground separation installed to control air movement through the building envelope. Components of the Air Barrier Assembly are specified in this Section and the following Sections:
 - 1. Section 061600 - SHEATHING
 - 2. Section 071100 - BITUMINOUS DAMPPROOFING
 - 3. Section 071300 - FLUID APPLIED WATERPROOFING
 - 4. Section 072100 - THERMAL INSULATION
 - 5. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING
 - 6. Section 076200 - SHEET METAL FLASHING AND TRIM
 - 7. Section 078400 - FIRESTOPPING
 - 8. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS
 - 9. Section 085110 - ALUMINUM WINDOWS

1.4 PERFORMANCE REQUIREMENTS

- A. General: Air barrier assembly 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, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air Barrier Assembly Air Leakage: Not to exceed 0.01 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.05 L/s x sq. m of surface area at 75 Pa); ASTM E 2357.

1.5 INDOOR AIR QUALITY REQUIREMENTS

- A. Volatile Organic Compounds: All products specified in this section shall comply with the following limits on content of VOC's:
 - 1. Adhesive: Maximum 250 grams/liter total VOC's
 - 2. Sealant: Maximum 250 grams/liter total VOC's
- B. No sealant specified in this section for interior installation shall contain aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium or hexavalent chromium.

1.6 SUBMITTALS

- A. General: Refer to Section 013300 - SUBMITTAL PROCEDURES, for submittal provisions and procedures.

- B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- C. Shop Drawings: Show locations and extent of dampproofing, waterproofing and air/vapor barriers. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining systems, and other termination conditions. Provide details at a minimum 6"=1'-0" scale.
 - 1. Include details of interfaces with other materials that form part of air/vapor barrier, dampproofing and waterproofing system for each type of exterior wall system, including but not limited to:
 - a. Details of each roof edge condition and roof to wall conditions where the air/vapor barrier interfaces with the roofing system
 - b. Details of each exterior wall footing condition
 - c. Details at the edge of slab and other locations where the deflection, control joints and expansion joints are required
 - d. Details at typical mechanical and electrical penetrations
 - e. Details at typical window, curtainwall, door frame and louver openings
 - f. Details where existing exterior wall air/ vapor barrier meets the air/vapor barrier of new exterior wall.
- D. Samples: For the following products:
 - 1. 12-by-12-inch (300-by-300-mm) square of air/vapor barrier membrane and transition materials.
 - 2. 12" long samples of each auxiliary material
- E. 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.
- F. Compatibility Statement:
 - 1. Waterproofing, Dampproofing, and Air/Vapor Barrier System: Provide written documentation from manufacturers of each specified system indicating that all components are compatible with one another.
- G. Qualification Data: For Applicator.

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. Demonstrate that the installer has successfully applied the specified air/vapor barrier product on at least three (3) similar size projects. Provide documentation that the applicator has completed the specified air/vapor barrier manufacturer's training program.
- B. Air/Vapor Barrier/ Waterproofing Mockups: Before beginning installation of air barrier, provide all waterproofing and air barrier materials for and construct mockups of exterior wall assembly(s) shown on Drawings, 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 the Work of this Section for the mock-ups with the Work of other trades to provide a complete mock-up of exterior envelope components.
2. Schedule construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.
3. Include junction with roofing membrane, building corner condition, window jamb, sill & head conditions, rectangular mechanical penetrations, round electrical or plumbing piping penetration, deflection joint condition, foundation wall intersection and other condition shown on the drawings or requested by the Architect.
4. Mock-up may be done as part of the Wall Panel Mock-up(s) in configuration shown on the drawings.
5. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
6. Do not apply air/vapor barrier, waterproofing and sheathing materials to the mock-up until the Pre-Installation Conference, described in this section, has commenced.

C. Preinstallation Conference: Conduct conference at Project site.

1. Include Air/Vapor Barrier Installer, Waterproofing Installer, Air/Vapor Barrier and Waterproofing Manufacturer's Representatives, Architect, General Contractor, Owner's Field Representative, Commissioning Agent, Owner's Testing Agent and installers of other construction connecting to waterproofing system and air barrier, such as roofing, masonry, sheathing, insulation, joint sealants, metal panel siding, windows, glazed curtain walls, and door frames.
2. Schedule conference after air/vapor barrier product data & shop drawing submittals have been approved and before air/vapor barrier, waterproofing and sheathing materials have been applied to the required Air/Vapor Barrier/ Waterproofing Mockup(s).
3. Review air/vapor barrier and waterproofing requirements including project details, specifications, compatibility, system tie-ins, surface preparation, substrate condition and pre-treatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, sequencing, coordination with other trades 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 for application of air barrier assembly, including primer and accessory materials. 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/VAPOR BARRIER FOR SHEATHING

- A. Modified Bituminous Sheet: 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick, polyethylene film with release liner on adhesive side and formulated for application with recommended primer that complies with VOC limits of authorities having jurisdiction.
1. Basis of Design: The basis of design for this project is Tremco, ExoAir 110/110LT.
 2. Equal 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. Henry Company; Blueskin SA.
 - c. Grace; Perm-A-Barrier.
 - d. Or approved equal.
 3. 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. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
 - b. Tensile Strength: 400 psi (2.7 MPa) 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 (minus 29 deg C); ASTM D 1970.
 - e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
 - f. Water Absorption: 0.15 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
 - g. Vapor Permeance: Maximum 0.05 perms (2.9 ng/Pa x s x sq. m); ASTM E 96, Water Method.

2.2 FLUID-APPLIED MEMBRANE AIR BARRIER FOR CONCRETE AND CMU

- A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Elastomeric, modified bituminous or synthetic polymer membrane.
1. Basis of Design: The basis of design for this project is Tremco, ExoAir 120.
 2. Equal Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Elastomeric Modified Bituminous Fluid Applied Membrane:
 - 1) Carlisle Coatings & Waterproofing; Barriseal.
 - 2) Henry Company; Air-Bloc 06.
 - 3) Grace; Perma-A-Barrier Liquid.
 - 4) Or approved equal.
 3. Physical and Performance Properties:
 - a. Membrane Air Permeance: Not to exceed 0.004 cfm x sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Membrane Vapor Permeance: Not to exceed 0.1 perm; ASTM E 96.
 - c. Elongation ASTM D 412 1500%
 - d. Chemical Resistance: Resists alkalis, mild acids and salt solutions
 - e. Color : Black
 - f. Solids Content: 62%

- g. Film Thickness: 60 mil dry.
- h. Maximum V.O.C. : 100 grams/liter

2.3 AUXILIARY MATERIALS FOR AIR/VAPOR BARRIER

- A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier.
 - 1. Tapes and strips shall be selected for compatibility with all substrates to which they will be adhered.
 - 2. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier material. Primer shall permit application at cold temperatures above 40 degrees F (4 degrees C).
- C. Air/Vapor Barrier Membrane Strips: Provide one or more of the following materials in widths indicated on Drawings, in accordance with manufacturer's recommendations and as required for continuous air barrier throughout exterior envelope of building.
 - 1. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.
 - 2. Counterflashing Strip: Modified bituminous 40-mil- (1.0-mm-) thick, self-adhering sheet consisting of 32 mils (0.8 mm) of rubberized asphalt laminated to an 8-mil- (0.2-mm-) thick, crosslaminated polyethylene film with release liner backing, Tremco Exoair-TWF or equal.
 - 3. Butyl Strip for Transition to roofing Membrane: Vapor-retarding, 30- to 40-mil- (0.76- to 1.0-mm-) thick, self adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive, with release liner backing.
 - 4. Isolation Materials: 20-ga. sheet metal, polymeric film or other membrane material recommended by manufacturer of air/vapor barrier membrane to separate incompatible materials.
- D. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
- E. Termination Mastic for Self-Adhering Sheet Membrane: Cold fluid-applied elastomeric liquid; trowel grade.
- F. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive adhesive tape.
- G. Stainless-Steel Sheet (Termination Bar and for Gaps): ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- H. Sealant Materials Required for Continuity of Air Barrier Assembly: Coordinate the Work of this Section with other trades to provide continuous air barrier assembly that meets the requirements of this Section and Section 014000 – QUALITY REQUIREMENTS. Sealant work provided by other trades includes the following:
 - 1. 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.
2. 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, or other compatible sealant as recommended by the air barrier or waterproofing manufacturer. To be used at interior and exterior locations where in contact with the face of the air vapor barrier or sheet waterproofing membrane is required.
- I. Backer Rod: Closed-cell, non-absorbent, polyethylene foam or open-cell polyurethane foam backer rod for use behind air/vapor barrier at deflection joints; size as indicated or required to fill gap.

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 joints in sheathing substrate meet the manufacturer's recommendations for joint thickness.
 3. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 4. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 5. Verify that masonry joints are flush and completely filled with mortar.
 6. 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 (1.6 mm).
- 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.
- J. Where air barrier will be in contact with mastic coatings, coordinate sequencing and compatibility of materials prior to installation.

3.3 JOINT TREATMENT IN PREPARATION FOR INSTALLATION OF FLUID-APPLIED MEMBRANE

- A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions. Remove dust and dirt from joints and cracks complying with ASTM D 4258 before coating surfaces.
 1. Prime substrate and apply a single thickness of preparation coat strip extending a minimum of 3 inches (75 mm) along each side of joints and cracks. Apply a double thickness of air barrier membrane and embed a joint reinforcing strip in preparation coat.

3.4 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 modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) 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 as indicated.
- D. At end of each working day, seal top edge of strips and transition strips to substrate with ter-

mination 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, storefronts, and doors. Apply modified bituminous transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.
 - 1. 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 (150 mm) 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 and Z-furring framing to air barrier with an additional 6-inch- (150-mm-) wide, counterflashing 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 (150 mm) beyond repaired areas in strip direction.

3.5 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 (minus 4 and plus 5 deg C), 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 (16 deg C).
- B. Sheathing Joint Preparation:
 - 1. Fill all deflection, control and expansion joints with backer rod or other flexible backing material to provide membrane support.
- C. 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

(19-mm) fillets of termination mastic on horizontal inside corners.

- D. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations with termination mastic and according to ASTM D 6135.
- E. 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.
- F. Apply and firmly adhere modified bituminous sheets horizontally over area to receive air barrier sheets. Accurately align sheets and maintain a uniform 2-1/2-inch- (64-mm-) 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. Mark the air barrier as it is installed to indicate where steel studs are located to facilitate the proper location of fasteners by other systems.
- G. Apply continuous modified bituminous sheets over modified bituminous strips bridging substrate cracks, construction, and contraction joints.
- H. CMU: Install air barrier sheet horizontally against the CMU beginning at base of wall. Align top edge of air barrier sheet immediately below protruding masonry ties or joint reinforcement or ties and firmly adhere in place.
 - 1. Overlap horizontally adjacent sheets a minimum of 2 inches (50 mm) and roll seams.
 - 2. Apply overlapping sheets with bottom edge slit to fit around masonry reinforcing or ties. Roll firmly into place.
 - 3. Seal around masonry reinforcing or ties and penetrations with termination mastic.
 - 4. Continue the membrane into all openings in the wall, such as doors, windows, and terminate at points to maintain an airtight barrier that will not be visible from interior.
- I. Seal exposed edges of sheets at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. 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 butyl or modified bituminous strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates.
- K. 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.
- L. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, store-

fronts, and doors. Apply modified bituminous transition strip that a minimum of 3 inches (75 mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
- M. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, doors, mechanical and electrical penetrations and all other penetrations of air/vapor barrier membrane with foam sealant to ensure that a continuous air barrier is achieved.
- N. At end or each working day, seal top edge of membrane to substrate with termination mastic.
- O. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- P. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air barrier sheet extending 6 inches (150 mm) beyond repaired areas in all directions.
- Q. Do not cover air barrier until it has been tested and inspected by Owner's testing agency and air/vapor barrier manufacturer representative.
- R. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.6 INSTALLATION OF FLUID-APPLIED MEMBRANE AIR BARRIER

- A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.
- B. Apply air barrier membrane within manufacturer's recommended application temperature ranges.
- C. 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.
- D. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.
1. Vapor-Retarding Membrane Air Barrier: 60-mil (1.5-mm) dry film thickness.
- E. Apply strip and transition strip over cured air membrane overlapping 3 inches (75 mm) onto each surface according to air barrier manufacturer's written instructions.
- F. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.
- G. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Air/Vapor Barrier and Waterproofing Inspections by the Manufacturers Representative: The Air/Vapor Barrier and waterproofing installer shall coordinate with and be responsible to retain the air/vapor barrier manufacturer technical representative who shall provide periodic inspections of the workmanship of the Air/Vapor barrier installer. At least (2) field observations from the manufacturer's representative will be required during the progress of the work. Such observations shall be confirmed in writing and signed by the manufacturer representative and submitted to the Architect as an informational submittal.
- C. 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 or blisters.
 - 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 and let to dry for manufacturer's recommended drying time.
 - 7. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction with no fishmouths.
 - 8. Termination mastic has been applied on cut edges.
 - 9. Air barrier has been firmly adhered to substrate.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Fluid-applied air barrier membrane has achieved specified thickness.
 - 12. Compatible materials have been used.
 - 13. Transitions at changes in direction and structural support at gaps have been provided.
 - 14. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
 - 15. All penetrations have been sealed.
- D. Remove and replace deficient air barrier components and retest as specified above.

3.8 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 com-

pleted 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 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 the following:
 - 1. Factory-formed and field-assembled, concealed-fastener, lap-seam insulated wall panel system.
- B. Related Sections include the following:
 - 1. Section 051200 – STRUCTURAL STEEL FRAMING, for structural steel supports for metal wall panels.
 - 2. Section 054000 – COLD-FORMED METAL FRAMING for secondary support framing supporting metal wall panels.
 - 3. Section 061000 – ROUGH CARPENTRY for shims, blocking, and salvaged wood decking.
 - 4. Section 076200 – SHEET METAL ROOFING, SIDING, FLASHING AND TRIM for fasciae, copings, flashings and other sheet metal work not part of metal wall panel assemblies.
 - 5. Section 072500 –AIR BARRIERS, for air vapor barrier materials that require tie-into wall panel systems.
 - 6. Section 079200 – JOINT SEALANTS for field-applied sealants not otherwise specified in this Section.
 - 7. Division 8 – OPENINGS for windows and curtain wall.

1.3 DEFINITION

- A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal insulation, and accessories necessary for a complete weathertight system.

1.4 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. Air Infiltration for insulated metal panel: Air leakage through assembly of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) of wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 psf (76 Pa).
- C. Water Penetration: No water penetration when tested according to ASTM E 331 at a minimum differential pressure of 20 percent of inward-acting, wind-load design pressure of not less than 6.24 lb/sq. ft. (300 Pa) and not more than 12 lb/sq. ft. (575 Pa).
- D. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - 1. General: The intent of these specifications is to meet or exceed the requirements of the New Hampshire State Building Code, 7th edition.
 - 2. Wind Loads: Determine loads based on the following minimum design wind pressures:
Uniform pressure as indicated on Drawings.
 - 3. 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.
 - a. Test Pressures: 150 percent of inward and outward wind-load design pressures.
- E. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to the New Hampshire State Building Code.
- F. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 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. 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.
 - 1. Accessories: Include details of the following items, at a scale of not less than 6 inches per 12 inches:
 - a. Flashing and trim.
- C. Calculations: 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. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
 - 1. Wall panels and attachments.
 - 2. Stud framing.
 - 3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
- E. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
 - 1. Include similar Samples of trim and accessories involving color selection.
 - 2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 - 1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 - 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - 3. Corner Treatment: 12 inches (300 mm) long each side of corner, by 12 inches (300 mm) high, showing panels, inside and outside corner trim and related accessories.
 - 4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
 - 5. Exposed Gaskets: 12 inches (300 mm) long.
 - 6. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- G. Qualification Data: For Installer, professional engineer and testing agency.
- H. 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.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 - 1. Metal Wall Panels: Include reports for air infiltration, water penetration, and structural performance.
- J. Maintenance Data: For metal wall panels to include in maintenance manuals.
- K. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. 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 structural engineering services, certified in the state of New Hampshire, needed to assume engineering responsibility.
 - 2. Engineering Responsibility: Preparation of data for each metal wall panels system type,

including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

- B. Testing Agency Qualifications: Required tests shall be performed by agencies qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
- C. Source Limitations: Obtain each type of metal wall panel through one source from a single manufacturer.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- 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.
 - a. Perform tests under environmental conditions replicating those that will exist during installation.
 - 2. Submit no fewer than nine 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 joint-sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
- F. Mockups: Provide materials for and build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Build mockup of typical wall panel as shown on Drawings; full thickness, including insulation, supports, attachments, and accessories.
 - 2. Do not apply wall panel materials to the mock-up until the Pre-Installation Conference, described in this section, has commenced.
 - 3. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
 - 4. Air Barrier Quality Control: Before the metal siding has been installed, this mockup may also be used to comply with requirements for air barrier quality control, as specified in Section 071000-DAMRPOOFING, WATERPROOFING AND AIR VAPOR BARRIERS
 - 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - 1. Meet with 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. Schedule conference after wall panel product data & shop drawing submittals have been approved and before wall panel materials have been applied to the required mockup(s).
 - 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 methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
 5. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 6. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
 8. Review temporary protection requirements for metal wall panel assembly during and after installation.
 9. Review wall panel observation and repair procedures after metal wall panel installation.
 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 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 weather-tight 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. 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.

1.8 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.

1.9 COORDINATION

- A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorro-

sive installation.

B. Coordinate with Work of section 101400 – Signage:

1. Deliver indicated panels to signage contractor, who will provide graphics on panels and return to panel contractor for installation as part of this Work.

1.10 WARRANTY

- A. 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FOAMED-INSULATION-CORE METAL WALL PANELS-CONCEALED-FASTENER, LAP SEAM

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed-in-place during fabrication with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
1. Panel Performance:
 - a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297.
 - b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for 7 days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
 - c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at 200 deg F according to ASTM D 2126.
 - d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for 7 days at minus 20 deg F according to ASTM D 2126.
 - e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. positive and negative wind load and with deflection of L/180 for 2 million cycles.
 - f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
 - g. Fire-Test-Response Characteristics: Class A according to ASTM E 108.
 2. Isocyanurate Insulation-Core Performance:
 - a. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
 - b. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
 - c. Shear Strength: 26 psi when tested according to ASTM C 273.

- B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
 - 1. Available Products:
 - a. Kingspan Insulated Panels; R-Span 300 R Striated.
 - b. (Basis of Design) CENTRIA Architectural Systems; Versawall.
 - c. Metl-Span; CF Striated.
 - 2. Facings: Fabricate panel with exterior and interior facings as specified below.
 - a. Material: Aluminum zinc-coated (galvalume) AZ50 steel sheet, 22 gauge thick at exterior panel and 26 gauge at interior panel.
 - b. Finish: 4-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat and clear coats. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Color: Up to four custom colors as selected by Architect, including vibrant and metallic colors.
 - 2) Pattern: Provide metal panel in three alternating colors for each building elevation as selected by Architect.
 - c. Interior Facing Finish: Manufacturer's standard 0.2 mil primer aiwth 0.6 mil acrylic.
 - 3. Panel Thickness: 4 inches.
 - 4. Panel Module: Varies, coordinate panel module with openings and elevations as indicated on the Drawings.
 - 5. Trim & Metal Closures: Custom profiles as shown on the drawings.

2.2 MISCELLANEOUS METAL FRAMING FOR METAL PANELS

- A. Provide metal framing and attachment systems for metal wall panels as recommended by manufacturer to meet indicated design loads.
- B. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653, G60, hot-dip galvanized zinc coating.
- C. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch (1.5-mm) bare steel thickness, shop-painted, cold-formed, metallic-coated steel sheet.
- D. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
- E. J-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
- F. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.3 MISCELLANEOUS MATERIALS

- A. 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 410 stainless or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
 - 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.
 - 4. Clips: Manufacturer's standard clips as required for installation of panels.
- B. Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.
- C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 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.
 - 1. Closures: Provide head closure piece and closures at eaves and rakes, fabricated of same metal and thickness as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Insect Mesh: Fused, entangled polymer filaments heat-bonded to each other to form a rigid mat comprising an open, three-dimensional geomatrix.
Product:
 - 1. Colbond Industries, *Enkamat*, or equal by approved manufacturer.
- C. Custom Closure, Flashing and Trim: Formed from same gauge as panels, 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.

2.5 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. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.
- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Exposed Mitered/Welded Corners shall be fabricated from 0.050 aluminum substrate and coated with the same color/finish as the panels. These corners shall be furnished in the same profile and width as the panels. Leg length of each corner shall be 13".
- E. Where indicated, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- F. Sheet Metal Accessories: Fabricate flashing and 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. Exterior only: 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.

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. 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. Install flashings and other sheet metal to comply with requirements specified in Section 076200 – SHEET METAL FLASHING AND TRIM.
- C. 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.
- D. Coordinate work with the installation of air vapor barrier specified in Section 072500 – Air Barriers, and rigid insulation specified in Section 072100 – Thermal Insulation.

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. Predrill 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 concealed screw fasteners in predrilled 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. Concealed Fasteners:
1. Steel Wall Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and 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.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal wall panel manufacturer.
1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."
 3. Seal all ends of panels with manufacturer's recommended sealant to protect insulation from moisture.
- E. Provide support framing where not indicated to be provided by others.

3.4 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, 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 (3 m) with no joints allowed within 24 inches (600 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), nonaccumulative, on level, plumb, and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner will engage a qualified independent testing and inspecting agency to perform the following field tests and inspections and prepare test reports. The Contractor shall notify the Owner when the installation is ready for testing, and shall cooperate with the Owner's testing agency as needed to test siding in a timely manner.
 - 1. Water-Spray Test: After completing the installation of 75-foot- (23-m-) by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal wall panel installation, including accessories. Report results in writing.
- C. Remove and replace applications of metal wall panels where inspections indicate that they do not comply with specified requirements.
- D. Additional tests and inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

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 074210

METAL ROOFTOP 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.
- 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 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. Factory-formed and field-assembled, perforated metal wall panels for mounting on roof.
 - 2. Factory-formed and field-assembled, acoustic barrier screen metal wall panels for mounting on roof.
 - 3. C-channels, secondary framing, anchors, and accessories.
- B. Related Sections include the following:
 - 1. Section 051200 – STRUCTURAL STEEL FRAMING, for structural steel supports for metal wall panels.
 - 2. Section 061000 – ROUGH CARPENTRY for shims, and blocking.
 - 3. 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. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 330:
 - 1. General: The intent of these specifications is to meet or exceed the requirements of the local State Building Code, current edition.
 - 2. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure as indicated on Drawings.

3. 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.
 - a. Test Pressures: 150 percent of inward and outward wind-load design pressures.
- C. Seismic Performance: Provide metal wall panel assemblies capable of withstanding the effects of earthquake motions determined according to the local State Building Code.
- D. Thermal Movements: Provide metal wall panel assemblies that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for metal wall panel and accessory.
- B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, secondary framing, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled work.
 1. Accessories: Include details of the following items, at a scale of not less than 6 inches per 12 inches:
 - a. Flashing and trim.
- C. Calculations: 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. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and framing items. Show the following:
 1. Acoustic panels and attachments.
 2. Secondary framing.
- E. Samples for Initial Selection: For metal acoustic panel indicated with factory-applied metallic color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
 2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- F. Samples for Verification: For exposed finish required, prepared on Samples of size indicated below.

1. Metal Wall Panels: 12 inches (300 mm) long by actual panel width. Include C-channels, fasteners, closures, and other metal wall panel accessories.
 - a. Provide metal wall panel with C-channel attachment.
 2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 3. Corner Treatment: 12 inches (300 mm) long each side of corner, by 12 inches (300 mm) high, showing panels, inside and outside corner trim and related accessories.
 4. Accessories: 12-inch- (300-mm-) long Samples for each type of accessory.
 5. Exposed Gaskets: 12 inches (300 mm) long.
 6. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- G. Qualification Data: For Installer, professional engineer and testing agency.
- H. 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.
- I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
1. Metal Wall Panels: Include reports for structural and acoustical performance.
- J. Maintenance Data: For metal wall panels to include in maintenance manuals.
- K. Warranties: Special warranties specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. 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.
- B. Fabricator Qualifications: Certified by metal wall panel manufacturer to fabricate and install manufacturer's wall panel system.
- C. 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 structural engineering services, certified in the project location, needed to assume engineering responsibility.
 2. Engineering Responsibility: Preparation of data for metal wall panels system, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

- D. Testing Agency Qualifications: Required tests shall be performed by agencies qualified according to ASTM E 329 for testing indicated.
- E. Source Limitations: Obtain metal wall panel through one source from a single manufacturer.
- F. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal wall panels and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- G. 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.
 - a. Perform tests under environmental conditions replicating those that will exist during installation.
 - 2. Submit no fewer than nine 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 joint-sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
- H. Mockups: Provide materials for and build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Build mockup of typical wall panel as shown on Drawings; full thickness, including, supports, attachments, and accessories.
 - 2. Do not apply wall panel materials to the mock-up until the Pre-Installation Conference, described in this section, has commenced.
 - 3. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to metal acoustic 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.
 - 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, 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.

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. 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 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 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, correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate metal acoustic panel assemblies with flashing, trim, and construction of girts, studs, 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 (Including Mica Finishes): 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: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTIC BARRIER SCREEN METAL WALL PANELS

- A. Barrier Wall Panels (Roof Mounted), Exterior:
 - 1. Empire Acoustical Systems "Silent Screen" barrier panel, 12 inches wide; 2-3/4 inch thick, 22-ga., galvanized perforated panel with 16 ga. galvanized steel non-perforated backing, with 2" mineral rock wool insulation board (6 lb. density) sandwiched between. The panels should be mounted approximately 10 to 16-inches above the roof, refer to Architectural details for additional mounting height requirements.
 - 2. Equal Manufacturers: Kinetics Noise Control, Industrial Acoustics Company.
- B. Acoustic Performance:
 - 1. NRC: 1.05 (ASTM C423).
 - 2. STC: 35 (ASTM E90).

2.2 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. Available Manufacturers:
 - 1. CENTRIA Architectural Systems.
 - 2. Fabral, Inc.
 - 3. Reynolds Metals Company.

- B. Basis-of-Design Product: Centria Architectural Systems, *EcoScreen Perforated Screenwalls*, or an equivalent product of one of the following:
- C. General: Provide factory-formed metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for weathertight installation.
- D. Corrugated-Profile, Exposed-Fastener Metal Wall Panels: Formed with alternating curved ribs spaced at 3/4" o.c. across width of panel, equal to Econolap 3/4", Centria.
 - 1. Material: Aluminum sheet, 0.040 inch (1.02 mm) thick.
 - a. Finish: 3-coat fluoropolymer, both sides.
 - b. Color: Custom color as selected by Architect.
 - 2. Panel Coverage: As selected by Architect from manufacturer's full range.
 - 3. Perforations: Provide 1/8" diameter perforations with 10 percent open area in reverse pattern, spaced 3/8" apart.
 - 4. Radius: Form metal panels to radius indicated on drawings.
- E. Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
 - 2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 MISCELLANEOUS METAL FRAMING

- A. Steel Sheet Components, General: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G90 (Z275) coating
- B. Subgirts: C- or Z-shaped sections fabricated from 0.0598-inch (1.5-mm) bare steel thickness, shop-painted, cold-formed, metallic-coated steel sheet.
- C. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
- D. J-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), galvanized steel with minimum bare metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
- E. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 MISCELLANEOUS MATERIALS

- A. 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 410 stainless or zinc-alloy steel

- hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
 - 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.
 - 4. Clips: Manufacturer's standard clips as required for installation of panels.
- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.5 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.
- 1. Closures: Provide head closure piece and closures at eaves and rakes, fabricated of same metal and thickness as metal wall panels.
 - 2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 - 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- B. Insect Mesh: Fused, entangled polymer filaments heat-bonded to each other to form a rigid mat comprising an open, three-dimensional geomatrix.
Product:
- 1. Colbond Industries, *Enkamat*, or equal by approved manufacturer.
- C. Flashing and Trim: Formed from 0.0179-inch- (0.45-mm-) 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.

2.6 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. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Where indicated, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel assembly.
- E. Sheet Metal Accessories: Fabricate flashing and 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.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical 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 structural framing to verify that girts, angles, channels, studs, and other panel support members and anchorage can be installed within alignment tolerances required by metal wall panel manufacturer.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.2 PREPARATION

- A. Miscellaneous Framing: Install Z-channels, 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. Coordinate the installation of metal framing elements with air barrier membrane and thermal rigid insulation installation.

3.3 METAL PANEL INSTALLATION, GENERAL

- A. General: Install metal acoustic panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts, unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cutting of metal 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. Predrill panels.
4. Install screw fasteners in predrilled holes.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as metal wall panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

- B. 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 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 architectural details, performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Set units true to line and level as indicated.

1. 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).

3.5 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.

3.6 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.
- D. Touch-up abraded surfaces of adjacent galvanized steel with zinc-rich primer in accordance with Section 055000 – Metal Fabrications.

END OF SECTION

SECTION 075400

THERMOPLASTIC MEMBRANE ROOFING

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 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. Adhered membrane roofing system.
 - 2. Decorative roofing ballast.
 - 3. Vapor retarder.
 - 4. Mechanically attached and adhered, tapered and flat roof insulation systems.
 - 5. Protection board, thermal barrier board, and all accessories required for a complete installation.
 - 6. Flashing for roof system penetrations, including those due to work of Divisions 5, 22, 23 and 26.
- B. Related Sections include the following:
 - 1. Concrete pads: Section 033000 – CAST-IN-PLACE CONCRETE.
 - 2. Roof deck substrate: Section 053100 – STEEL DECKING.
 - 3. Wood nailers, curbs, and blocking: Section 061000 – ROUGH CARPENTRY.
 - 4. Roof penetration flashings, flashings, and counterflashings: Section 076200 – SHEET METAL FLASHING AND TRIM.
 - 5. Requirements for sealants to be used throughout the Project: Section 079200 – JOINT SEALANTS.
 - 6. Structural, Mechanical and electrical roof penetrations and rooftop units: Division 5, 22, 23 and 26.
 - 7. Roof membrane tie-in with air barrier requirements: Section 072500 – AIR BARRIERS.”

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 membrane manufacturer based on testing and field experience.
- C. FMG Listing: Provide roofing membrane, base flashings, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
 - 1. Fire/Windstorm Classification: Class 1A- 90.
 - 2. Hail Resistance: MH.

1.5 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work; minimum scale shall be 6" = 1'-0" for all details.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns.
 - 4. Roof hatches.
- D. Samples for Verification: Submit at least one sample of each product included in the work of this Section, including but not limited to the following products:
 - 1. 12-by-12-inch (300-by-300-mm) square of each type of sheet roofing, of color specified, including T-shaped side and end lap seam.
 - 2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
 - 3. 12-by-12-inch (300-by-300-mm) square of protective board.
 - 4. 12-by-12-inch (300-by-300-mm) square of roof insulation.
 - 5. 12-by-12-inch (300-by-300-mm) square of vapor retarder.
 - 6. 12-inch (300-mm) length of metal termination bars.
 - 7. Six insulation fasteners of each type, length, and finish.
 - 8. Six roof cover fasteners of each type, length, and finish.
- E. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- F. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.

- G. Qualification Data: For Installer and manufacturer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.
- I. Research/Evaluation Reports: For components of membrane roofing system.
- J. Maintenance Data: For roofing system to include in maintenance manuals.
- K. Warranties: Special warranties specified in this Section.
- L. Inspection Report:
 - 1. During installation: Log of manufacturer's weekly inspections, daily seam tests and related quality control measures.
 - 2. After completion: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty.
 - 1. The Roofing Subcontractor shall submit written evidence of not less than five (5) years' experience in the application of the specified roofing systems using the materials of the manufacturer proposed for this Project.
 - 2. The Roofing Subcontractor shall submit a statement from the roofing materials manufacturer that roofer is certified by the manufacturer for the application of the specified roofing materials.
- B. Manufacturer Qualifications: A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.
 - 1. The manufacturer of the membrane roofing system and related items shall submit written evidence that it is, and has been for at least ten (10) years, continuously engaged in the manufacture of the type of thermoplastic membrane roofing systems specified herein.
 - 2. The manufacturer shall submit the names and addresses of at least five (5) projects of similar size and scope, where said roofing system has been in place for at least five (5) years.
- C. Testing Agency Qualifications: All required test reports shall be prepared by an independent testing agency with the experience and capability to conduct the testing indicated, according to ASTM E 329.
- D. Source Limitations: Obtain all components for membrane roofing system from or approved by roofing membrane manufacturer.
- E. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable

testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and roof slopes indicated.
2. Fire-Resistance Ratings: ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

F. Preinstallation Conference: Conduct conference at Project site.

1. Comply with requirements in Section 011100 – SUMMARY OF THE WORK.
 - a. All roofing submittals must be made and approved prior to this meeting.
 - b. Meet with Owner, Owner's Project Manager, 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 system including, but not limited to, the following:
 - a. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - c. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - d. Review structural loading limitations of roof deck during and after roofing.
 - e. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - f. Review governing regulations and requirements for insurance and certificates if applicable.
 - g. Review temporary protection requirements for roofing system during and after installation.
 - h. Review roof observation and repair procedures after roofing installation.
3. Review scheduling and coordination requirements:
 - a. Establish trade-related job schedules, including installation of mechanical equipment.
 - b. Establish schedules and work methods that will prevent damage to roofing or the work of other trades.
 - c. Require that all new penetrations and walls be in place prior to installing permanent roofing.
 - d. Establish areas on the job site for materials storage.
 - e. Establish weather and working temperature conditions to which all parties shall conform.
 - f. Establish conditions under which temporary roofing will be used.
 - g. Establish provisions for on-site monitoring after completion of the Work.
 - h. Review roof substrate construction for correction of unacceptable conditions.

G. Mock-Ups: Provide mock-ups for review and approval prior to installation. Coordinate with commissioning agent's review and envelope testing. Mock-ups will be required, but not limited to, the following conditions:

1. Roof to wall flashing conditions
2. Each type of roof penetration & curb conditions

3. Each type of roof edge detail

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. Permissible Dates for Application of Water-based Adhesives: Between 15 April and 1 October, or more restrictive, as required by manufacturer of roofing system.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard full system warranty, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.
 1. Special warranty includes roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, protective boards, vapor retarder, walkway products and other components of membrane roofing system.
 2. Warranty Period: **20** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PVC ROOFING MEMBRANE

- A. PVC Sheet: ASTM D 4434, Type II, Grade 1, fiber reinforced, as follows:

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Duro-Last Roofing, Inc.
 - b. Firestone Building Products Company.
 - c. Sarnafil, Inc.
 - d. Seaman Corporation, Fiber-Tite Roofing Systems
 2. Thickness: 60 mils (1.5 mm) certified polymer thickness, minimum.
 3. Exposed Face Color: White for all horizontal surfaces.
 - a. Solar Reflectance Index: 78 minimum.
 - b. Contrasting color for all vertical membrane flashing surfaces and for canopy roof surfaces as selected by Architect from manufacturers full range of available colors.
 4. Physical Properties:
 - a. Tensile Strength: 1600 psi (11.1 kN);; ASTM D 638.
 - b. Elongation at Break: 250 percent; ASTM D 638.
 - c. Tear Resistance: 14 lbf (63.0 N), ASTM D 1004.
 - d. Seam Strength: Minimum 80% of tensile strength; ASTM D 638.
 - e. Resistance to Heat Aging: 95 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240° F (116° C); ASTM D 573.
 - f. Linear Dimension Change: Plus or minus 0.02 percent; ASTM D 1204.
 - g. Low Temperature Flexibility: Pass at -40° F (-40° C), ASTM D 2136.
- B. Basis of Design: *Sarnafil G410* as manufactured by Sarnafil Inc., 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 VOC limits of authorities having jurisdiction. If the manufacturers recommended auxiliary materials exceed the limits of authorities having jurisdiction, review acceptable alternatives and possible variances with Architect and provide means to prevent migration of odors within adjacent and nearby occupied spaces.
 2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Single-Ply Roof Membrane Adhesives: 250 g/L.
 - f. Single-Ply Roof Membrane Sealants: 450 g/L.
 - g. Nonmembrane Roof Sealants: 300 g/L.
 - h. Sealant Primers for Nonporous Substrates: 250 g/L.
 - i. Sealant Primers for Porous Substrates: 775 g/L.
 - j. Other Adhesives and Sealants: 250 g/L.
 3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources

Using Environmental Chambers."

- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as thermoplastic sheet membrane. Flashing at vertical surfaces shall be in color as selected by Architect.
 - C. Crimped-on Metal Fascia:
 - 1. Composition:
 - a. Sheet Metal- Titanium zinc alloy sheet fascia provided under section 076200 - SHEET METAL FLASHING AND TRIM.
 - 2. Profile: Custom profiles as shown on Drawings.
 - 3. Continuous stainless steel cleat shall be provided under this section to accommodate crimped-on fascia provided under other sections listed above. Cleat shall be fastened in a staggered manner with fasteners recommended by the manufacturer.
 - a. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.
 - D. Bonding Adhesive: Manufacturer's recommended water-based bonding adhesive for membrane, and solvent-based bonding adhesive for base flashings. Manufacturer's standard solvent-based bonding adhesive may be used for membrane only when ambient conditions prevent the use of water-based adhesive, in which case every effort must be made to prevent contact of adhesive with insulation.
 - E. Metal Termination Bars: Manufacturer's standard predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
 - F. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
 - 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. Sealant: Provide manufacturer's recommended sealant compatible with air vapor barrier to provide air-tight conditions between roofing membrane and adjacent systems air barrier."
 - I. Decorative Ballast: 1-1/2 inch diameter gray river rock, iron free.
- 2.3 VAPOR RETARDER
- A. General: Provide vapor retarder approved by Factory Mutual and by manufacturer of roofing system, and shown to be compatible with all materials with which it will be in contact.
 - B. Self-Adhering Sheet Vapor Retarder: ASTM D 1970, minimum 40-mil- thick film laminated to layer of rubberized asphalt adhesive; maximum permeance rating of 0.1 perm; cold-applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor-retarder manufacturer.

2.4 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.
 - 1. Minimum thickness of insulation shall be as required to provide a thermal resistance equal to or greater than R-30, unless otherwise 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 1/4 inch per 12 inches (1:48) minimum in the field and 1/2" per 12" (1:24) minimum at roof drain sumps, crickets, and as indicated or otherwise required by roofing manufacturer.
- 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: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with all components of membrane roofing system.
- 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. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate, between insulation layers and compatible with insulation to be used only at locations where mechanical fastening is impractical.
- D. Protection and Thermal Board: Provide the following or equivalent moisture-resistant material, as recommended by manufacturer of approved roofing system:
 - 1. Glass-mat, water-resistant gypsum substrate, ASTM C 1177/C 1177M, 1/2 inch (13 mm) thick.
 - a. Product: Dens-Deck Prime as manufactured by Georgia Pacific, or approved equal.
- E. Acoustical Thermal Board: Provide the following or equivalent moisture-resistant material, as recommended by manufacturer of approved roofing system:
 - 1. Gypsum -Fiber Board, ASTM E84 & D3273, 5/8" inch thick.
 - a. Product: Securock as manufactured by USG, or approved equal.

- b. Location: Under mechanical roof top equipment as indicated on the drawings.

2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 0.096 (96 mil/2.4 mm) 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. Where roofing will be installed above or adjacent to concrete, 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. Self-Adhering Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering sheet vapor retarder over area to receive vapor retarder, side, and end lapping each sheet a minimum of 3-1/2 inches and 6 inches, respectively. Seal laps by rolling.

- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into membrane roofing system.

3.4 INSULATION 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 two or more layers of insulation under area of roofing to achieve required thickness. Install layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 12 inches (150 mm) in each direction.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill all gaps with spray foam that is compatible with roof insulation to achieve a continuous air tight condition.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
- G. Mechanically Fasten Insulation, & Protection Boards: Install vapor barrier base layer and subsequent layers of insulation, and protective board to roof deck using mechanical fasteners specifically designed and sized for fastening specified board type roof insulation with deck type in accordance with manufacturers recommendations.
 - 1. Fasten insulation, and protection boards according to requirements in the FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation and protection boards to resist Uplift pressure at corners, perimeter and field of roof.
- H. Install protection boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Stagger joints from joints in insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt protection boards together and fasten through insulation to roof deck.
- I. Apply insulation adhesive at selective locations (such as crickets and where fastening is impractical) in accordance with requirements of the roofing manufacturer.

3.5 ADHERED 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. 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. Water-Based Bonding Adhesive: Apply water-based bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane.
 - 1. Do not apply bonding adhesive to splice area of roofing membrane.
 - 2. Use water-based adhesive only in ambient conditions approved by the manufacturer of the roofing system.
- E. Solvent-Based Bonding Adhesive: Apply solvent-based bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply bonding adhesive to splice area of roofing membrane.
- F. Mechanically or adhesively fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roofing membrane with side laps shingled with slope of roof deck.
- H. 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 three times daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
 - 4. Record in a log the results and corrections as needed.

3.6 INSTALLATION of BASE FLASHING AND EDGE STRIP

- 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 sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.7 FIELD QUALITY CONTROL

- A. The Owner, may, at its discretion, engage the services of an independent consultant to review the installation of the roof on a full time or periodic basis above and beyond the contractor's quality control and testing program. Such additional quality control in no way relieves the Contractor from the responsibility to meet specified requirements and perform quality control as specified herein."
- B. Daily Testing: The Contractor shall monitor the quality of the membrane seams by probing the seams each day. In addition, 3 seam cross section cuts shall be made and repaired each day to permit examination of seam quality. Notify the Owner's Field Representative in advance of conducting tests, and make arrangements for the Field Representative to inspect the seam cuts as requested.
- C. Manufacturer's Inspections & Contractor's Quality Control Program: The Contractor shall implement a program of inspection and quality control during roofing installation work to ensure the highest quality of work in accordance with manufacturer guidelines and recommendations. The Contractor is also responsible for arranging inspections by the manufacturer's technical field representative on a periodic basis or as required to fulfill warranty requirements and submission of inspection reports to the Architect from these site visits. The Contractor shall arrange and pay for fastener pull-out tests by the manufacturer of the fasteners to confirm the integrity of the fastening system and as required by the roofing manufacturer for warranty purposes.
- D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- E. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do 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.

3.8 PROTECTING AND CLEANING

- A. Protection of membrane roofing system shall be provided by General Contractor during remainder of construction period. 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 to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.9 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS **<Insert name>** of **<Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
1. Owner: **<Insert name of Owner.>**
 2. Address: **<Insert address.>**
 3. Building Name/Type: **<Insert information.>**
 4. Address: **<Insert address.>**
 5. Area of Work: **<Insert information.>**
 6. Acceptance Date: **<Insert date.>**
 7. Warranty Period: **<Insert time.>**
 8. Expiration Date: **<Insert date.>**
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
lightning;
 - a. peak gust wind speed exceeding **<Insert wind speed>** mph (m/sec);
 - b. fire;
 - c. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - d. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - e. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects

work covered by this Warranty.

6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: <Insert signature.>
2. Name: <Insert name.>
3. Title: <Insert title.>

END OF SECTION

SECTION 076200

SHEET METAL ROOFING, SIDING, FLASHING AND TRIM

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 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. Standing seam sheet metal roofing and siding.
 - b. Rigid insulation/nailbase panels, felt and slip sheet.
 - c. Vapor retarder.
 - d. Manufactured reglets.
 - e. Manufactured through-wall flashing.
 - f. Formed low-slope roof flashing and trim.
 - g. Formed wall flashing and trim.
 - h. Roof edge fascia.
 - i. Downspouts, gutters, and scuppers for all roof types.
 - j. Snow guards.
 - k. Accessories.
- B. Items To Be Furnished Only: Furnish the following items for installation by the designated Sections
 - 1. Section 033000 – CAST-IN-PLACE CONCRETE,
 - a. Reglets.
- 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 exterior plywood sheathing, nailers, curbs, and blocking.
 - 2. Section 075400 - THERMOPLASTIC MEMBRANE ROOFING for installing sheet metal flashing and trim integral with roofing membrane; cleats for roof fascia.

3. Section 079200 - JOINT SEALANTS for field-applied sheet metal flashing and trim sealants.
4. Section 079500 - EXPANSION CONTROL for manufactured sheet metal expansion-joint covers.

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. Sheet Metal Roofing and Siding: Provide complete sheet metal roofing system, including, but not limited to, on-site, roll-formed metal roof and wall panels, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.
 1. Wind-Uplift Resistance: Provide portable roll-forming equipment capable of producing sheet metal roofing assemblies that comply with UL 580 for Class 90 wind-uplift resistance.
- C. Fabricate and install roof edge flashing and copings capable of resisting the following forces required by Code according to recommendations in FMG Loss Prevention Data Sheet 1-49:
- D. 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.
- E. Water Infiltration: Provide sheet metal roofing, siding, flashing and trim that do not allow water infiltration to building interior. Lap metal flashing and connections of sheet metal roofing to allow moisture to run over and off the material.

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. Shop Drawings: Show layouts of sheet metal roofing, siding, flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. In addition to preparing detailed shop drawings for the New Addition roof construction, the Contractor shall field survey and document all existing roof detail conditions throughout the various portions of the existing buildings and shall develop detailed shop drawings of each condition. Include the following:
 1. Sheet Metal Roofing and Siding:
 - a. Prepare plans and elevations to identify layout, seam spacing, locations of expansion joints and other features that penetrate or connect with sheet metal systems.

- b. Identify material, thickness, weight, and finish for each item and location in Project.
 - c. Details for forming sheet metal roofing, including seams and dimensions.
 - d. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments. Include pattern of seams.
 - e. Details of termination points and assemblies, including fixed points.
 - f. Details of expansion joints, including showing direction of expansion and contraction.
 - g. Details of roof penetrations.
 - h. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings.
 - i. Details of special conditions, including snow guards, interface with flashing, and roof curbs.
 - j. Details of connections to adjoining work.
 - k. Layout of supports & spacing of snow guards
 - l. All shop drawings shall be at 6"=1'-0" scale.
 - 2. Sheet Metal Flashing and Trim:
 - a. Prepare typical layout showing patterns for fasteners.
 - b. Identify material, thickness, weight, and finish for each item and location in Project.
 - c. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 - d. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 - C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
 - 1. Sheet Metal Roofing and Siding: 12 inches (300 mm) long by actual panel width, including finished seam. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Snow Guards: Full-size Sample.
 - 3. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
 - 4. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - 5. Accessories: Full-size or 12-inch- (300-mm-) long samples for each type of accessory.
 - 6. Roof Drainage Accessories: Full-size samples of each.
 - D. Qualification Data: For Installer.
 - E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sheet metal roofing portable roll-forming equipment. Include reports for structural performance.
 - F. Warranties: Special warranties specified in this Section.
- 1.5 QUALITY ASSURANCE
- A. Installer Qualifications: Fabricator of sheet metal roofing, siding, flashing and trim that employs skilled workers who custom-fabricate sheet metal roofing similar to that required for this Project and whose products have a record of at least five years of successful in-service performance.
 - B. 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.

1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."
- C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation. Refer to Drawings for mockup sizes and configurations.
1. Coordinate mock-up construction with the work of other Sections.
 - a. Mockup of sheet metal flashing and trim may be constructed as part of mockup required for Section 042000 – Unit Masonry.
 - b. Provide separate mockup of sheet metal siding and substrate.
 2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013119 – Project Meetings. Review methods and procedures related to sheet metal roofing, siding, flashing and trim systems including, but not limited to, the following:
1. Meet with Owner, Architect, Owner's insurer, if applicable, Owner's testing and inspection agency, if applicable, Installer, and installers whose work interfaces with or affects sheet metal roofing, siding, flashing and trim including installers of metal deck and sheathing, roof accessories, roof windows, and roof-mounted equipment.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays. Establish provisions for temporary storage of materials on-site in accordance with these specifications.
 3. Review methods and procedures related to sheet metal roofing, siding, flashing and trim.
 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays. Critical sequencing to be discussed includes:
 - a. Installation of mechanical equipment and other rooftop items.
 - b. Construction of penetrations and walls prior to installation of roofing and siding.
 - c. Installation of roof windows.
 - d. Scheduling the Work to avoid damage to roofing system.
 5. Examine deck and other substrate conditions for compliance with requirements, including flatness and attachment to structural members.
 6. Review structural loading limitations of metal deck and sheathing during and after roofing.
 7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting, including Factory Mutual (FM) and Underwriters Laboratory (UL) requirements, as applicable.
 8. Review temporary protection requirements for sheet metal roofing during and after installation.
 9. Review roof observation and repair procedures after sheet metal roofing installation.
 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. General: Follow recommendations of approved sheet metal manufacturer with respect to protection of sheet metal materials and fabrications from physical damage, moisture and other corrosive materials.

- B. Deliver sheet metal materials and fabrications undamaged. Protect sheet metal materials and fabrications during transportation and handling.
- C. Unload, store, and install sheet metal materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- D. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal materials in contact with other materials that might cause staining, denting, or other surface damage.
- E. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal roofing installation.

1.7 COORDINATION

- A. Coordinate installation of sheet metal roofing, siding, flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.
- B. Confirm compatibility of approved products with substrates and other materials with which sheet metal materials and fabrications will come in contact.

1.8 WARRANTY

- A. Special Roofing Installer's Warranty: Roofing Installer's warranty, signed by Roofing Installer, in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Loose parts.
 - c. Wrinkling or buckling.
 - d. Failure to remain weathertight, including uncontrolled water leakage.
 - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
 - f. Galvanic action between sheet metal roofing and dissimilar materials.
 - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 SHEET METALS

- A. Pre-Patinated Copper Sheet: Copper sheet with copper-chloride-hydroxides patina crystals applied to one surface.
 - 1. Copper Base: Standard, ounce-weight copper in conformance with ASTM B 370.
 - 2. Thickness: 0.027-inch (0.69-mm) thick (20-oz.), or 0.022-inch (0.55-mm) thick (16-oz.), as indicated or required to meet performance criteria.
 - 3. Exposed Finishes:
 - a. Surface: Smooth, flat finish.
 - b. Temporary protective coating as recommended by sheet metal manufacturer to prevent water staining during transit and storage, and to provide initial weathered appearance.
 - 4. Sheet Metal Product: Revere Copper Products, Inc., *EverGreen*, or equal.
- B. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.
- C. 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.

2.3 RIGID INSULATION/NAILBASE PANELS

- A. Acceptable Manufacturers and Products:
 - 1. Atlas Roofing Corporation, *ACFoam Cross-Vent*
 - 2. Cornell Corporation, *Vent-Top ThermaCal 1*
 - 3. Hunter Panels, *Cool-Vent*
- B. Vented Rigid Insulation/Nailbase Panels: Provide factory-bonded composite panels comprising insulation, wood spacers and plywood nailbase:
 - 1. Bottom Layer: Polyisocyanurate insulation, closed-cell,
 - a. Insulation Type: ASTM C12899-03, Type II, Grade 2 (20 psi).
 - b. Thickness of insulation: Minimum 1-1/2" inches.
 - 2. Middle Layer: Wood block spacers, 1-inch (25 mm) thick, adhered to insulation and spaced to support a 1-inch (25 mm) ventilation cavity permitting a minimum of 50 percent free air movement in all directions.
 - 3. Top Layer: 3/4-inch (19 mm) APA-rated plywood.
- C. Physical properties of panels:

1. Thermal resistance: R-40 minimum total combined insulations at roof types A2A and A2B. (rigid insulation only)
2. Compressive strength, per ASTM D1621: 20 psi.
3. Dimensional stability, per ASTM D2126: 2 percent linear change in seven days.
4. Moisture vapor transmission, per ASTM E96: less than 1 perm.
5. Water absorption, per ASTM C209: less than 1 percent by volume.
6. Flame spread, per ASTM E84: 25
7. Service temperature: -100 degrees F to 250 degrees F.

D. Product: Hunter Panels, LLC, *Cool-Vent*, or equal by approved manufacturer.

E. Sheet Metal Roofing System R2A: Nailbase panel assembly shall be 3-1/4 inches thick on top of 3-1/2 inches of polyisocyanurate insulation and vapor barrier as specified in Section 075400 – Thermoplastic Membrane Roofing.

2.4 UNDERLAYMENT MATERIALS

A. Building Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Slip Sheet: Rosin-sized paper, minimum 5 lb/100 sq. ft. (0.27 kg/sq. m).

C. Self-Adhering, High-Temperature Weatherproof Underlayment: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Performance requirements:

- a. Tensile strength of membrane, per ASTM D 412, Die C modified: 250 psi (1720 kPa)
- b. Elongation, per ASTM D 412, Die C modified: 250 per cent.
- c. Adhesion to plywood, per ASTM D 903: 3 lb./in. width (525 N/m)
- d. Permeance: 0.05 perm maximum.
- e. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
- f. Low Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970

2. Available Products:

- a. Carlisle Coatings & Waterproofing, Div. of Carlisle Companies Inc, *CCW WIP 403 HR Heat-Resistant Roofing Underlayment*
- b. Henry Company; *Blueskin PE200 HT Self-Adhered Roof Underlayment*.
- c. Or approved equal.

2.5 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing, and 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. Nails for Zinc-Tin Alloy-Coated Copper and Copper Sheet: Copper or hardware bronze,

- 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
 - 2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
 - 3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
 - 4. Clips: Copper, corrosion-free as recommended by manufacturer of sheet metal, designed to permit expansion and contraction of the panel system throughout the specified temperature range.
 - 5. Fasteners for masonry: Nylon expansion sleeves with stainless steel drive pins, Nailin as manufactured by Powers Fasteners, or approved equal.
- C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight and as recommended by sheet metal roofing manufacturer for installation indicated.
- E. Water Cut-off Mastic: Bituminous Coating; Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Metal Termination Bars: Standard flat style, 1 inch (25 mm) wide bar, fabricated from 1/8 inch (3 mm) thick Type 304 stainless steel, in conformance with ASTM A 167, with 1/4-inch (6-mm) diameter holes spaced 8 inches (203 mm) on center for screw attachment. Provide factory-applied foam strip on concealed surface of bar.
- 1. Available Products: Hohmann & Barnard, Inc., *Type T1-FTS Termination Bar*, or equal by approved manufacturer.

2.6 ACCESSORIES

- A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.
- 1. Closures: Provide closures at eaves and ridges, fabricated of same metal as sheet metal roofing.
 - 2. Clips: Minimum 0.0625-inch- (1.6-mm-) thick, stainless-steel panel clips designed to withstand negative-load requirements.
 - 3. Cleats: Mechanically seamed cleats formed from 16-oz./sq. ft. (0.55-mm-) thick copper sheet.
- B. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- C. Vented Closure Mesh: Free-draining, non-woven three-dimensional mesh, made from polymer strands that will not degrade within exterior wall and roof construction; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut to match sheet metal roofing profile. Provide closure strips where indicated or necessary to prevent entry of insects into voids.
- D. Roof Drainage Accessories:

1. Fabricate Gutters and Downspouts from the following material:
 - a. Patinated Copper: 0.022 inch (0.55 mm) thick (16-oz.).
 - b. Aluminum: 0.040 inch thick.
 2. Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Fabricate expansion joints and accessories from same metal as gutters, unless otherwise indicated.
 - a. Fabricate gutters with built-in expansion joints
 - b. Accessories: Bronze wire ball downspout strainer
 3. Downspouts: Fabricate downspouts to cross-section indicated, complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
 4. Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4 in. wide wall flanges to interior, and base extending 4 in. beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
- E. Snow Guard Fencings: Prefabricated, noncorrosive units designed to be installed without penetrating sheet metal roofing, and complete with predrilled holes, clamps, or hooks for anchoring.
1. Available Manufacturers:
 - a. Berger Brox. Co.
 - b. Metal Roof Innovations, Ltd.
 - c. TRA
 - d. Alpine Snowguards, a division of Vermont Slate & Copper Services, Inc.”
 2. Seam-Mounted, Bar-Type Snow Guards: Aluminum and copper rods or bars held in place by bronze and stainless-steel clamps and posts attached to vertical ribs of standing-seam sheet metal roofing.
 - a. Aluminum Finish: Mill finish.
 - b. Copper Finish: Patinated.
 - c. Product: Metal Roof Innovations, Lt., *S-5 SnoFence*, or equal by approved manufacturer.
- F. Splash Blocks: Provide precast concrete splash blocks.

2.7 FABRICATION OF SHEET METAL ROOFING AND SIDING

- A. General: Custom fabricate sheet metal roofing and siding to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
1. Material: Patinated Copper: 0.027 inch (0.69 mm) thick (20-oz.) for standing seam roof and siding, unless otherwise indicated or required to meet performance criteria; provide appropriate thicknesses of sheet metal to avoid oil canning appearance.
 2. Standing-Seam Roofing and Siding: Form standing-seam pans with finished double-lock seam height of 1 inch (25 mm); spacing 21" O.C. unless otherwise noted on Drawings.
- B. Fabricate sheet metal roofing and siding to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

1. Lay out sheet metal roofing and siding so cross seams, when required, are made in direction of flow with higher pans overlapping lower pans. Stagger cross seams.
 2. Allow for 1/8-inch (3-mm) expansion space at the base of each seam.
 3. Fold and cleat eaves and transverse seams in the shop.
 4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing and siding to profiles, patterns, and drainage arrangements shown and as required for leakproof construction.
- C. 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 (25 mm) deep, filled with sealant (concealed within joints).
- D. Metal Protection: Where dissimilar metals will contact each other, 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 manufacturers of dissimilar metals or by fabricator.

2.8 FABRICATION OF SHEET METAL FLASHING AND TRIM, 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.
1. Patinated Copper: 20 oz. unless otherwise indicated or required to meet performance criteria; provide appropriate thicknesses of sheet metal to avoid oil canning appearance.
 2. Aluminum: 0.050 inch thick unless otherwise indicated or required to meet performance criteria; provide appropriate thicknesses of sheet metal to avoid oil canning appearance.
- 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: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 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. 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 (25 mm) deep, filled with elastomeric sealant concealed within joints.
- E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.
- F. 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" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

2.9 ROOF EDGE SHEET METAL FABRICATIONS

- A. Fascia: Fabricate in minimum 96-inch- (2400-mm-) long sections. To be installed on cleat provided under section 075400-THERMALPLASTIC MEMBRANE ROOFING.
 - 1. Joint Style: Lap, minimum 4 inches (100 mm) wide.
 - 2. Fabricate in custom profile shown on Drawings.
 - 3. Fabricate from the following material:
 - a. Aluminum: 0.050 inch thick unless otherwise indicated or required to meet performance criteria; provide appropriate thicknesses of sheet metal to avoid oil canning appearance.

2.10 WALL SHEET METAL FABRICATIONS

- A. Flashing for Openings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend a minimum of 4 inches (100 mm) beyond wall openings, or further as shown on Drawings. Form head and sill flashing with 2-inch- (50-mm-) high end dams and back dams at sill locations. Fabricate from the following material:
 - 1. Patinated Copper: 20 oz. unless otherwise indicated or required to meet performance criteria.

2.11 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.
 - 1. Available Manufacturers:
 - a. Cheney Flashing Company, Inc.
 - b. Fry Reglet Corporation.
 - c. Sandell Manufacturing Company, Inc.
 - 2. Patinated Coated Copper: 0.022 inch (0.55 mm) thick (16-oz.), unless otherwise indicated or required to meet performance criteria.
 - a. Where reglets will not be exposed to view, copper: sheet, 0.022 inch (0.55 mm) thick (16-oz),. will be an acceptable material.
 - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
 - 5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
 - 6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.12 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 biodegradable, temporary, pre-weathered, 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, sheet metal roofing supports, and other conditions affecting performance of work.
 - 1. Examine solid plywood wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for roof drains, flashings, and penetrations through sheet metal roofing.
- B. Prior to installation of the following work, examine underlying air/vapor barrier for completeness and continuity, and confirm that it has been inspected and approved. Do not conceal air/vapor barrier materials without written approval from the Architect.
 - 1. Vented rigid insulation/nailbase panels for standing seam metal roofing
 - 2. Sheet metal flashing and trim.
- C. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal roofing, siding, 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 roofing, siding, flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Protection from Galvanic Action: 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 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. Protection from Weather: Perform operations so as to maintain integrity of roofing system and to protect insulation from the elements at all times.
- 1. Provide suitable water stops at end of each working day and during inclement weather. Cut off and discard waterstop material prior to recommencing work.
 - 2. Provide a "completed each day" application resulting in a complete watertight condition, at sheet metal roofing, siding, walls and other penetrations through roofing by the end of each working day and during inclement weather.

3.3 VAPOR RETARDER INSTALLATION

- A. General: Comply with requirements in Section 075400 - THERMOPLASTIC MEMBRANE ROOFING.

3.4 VENTED NAILBASE INSTALLATION

- A. Installation of Vented Rigid Insulation/Nailbase Panels for Roofing
- 1. Panels shall be laid out so that joints are supported by framing or blocking and that installation is within flatness tolerances for standing seam sheet metal roof.
 - 2. Fasten panels to substrate using fasteners recommended by manufacturer of panels, spaced as required to meet performance criteria specified in this Section.

3.5 UNDERLAYMENT INSTALLATION

- A. Installation of Weatherproof Underlayment: Install self-adhering sheet weatherproof underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply at locations indicated below and at locations indicated on Drawings, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
- 1. Roof perimeter for a distance up from eaves of 36 inches (900 mm) beyond interior wall line.
 - 2. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (150 mm).
 - 3. Rake edges for a distance of 18 inches (460 mm).
 - 4. Hips and ridges for a distance on each side of 18 inches (460 mm).
 - 5. Roof to wall intersections for a distance from wall of 18 inches (460 mm).
 - 6. Around dormers, chimneys, skylights, and other penetrating elements for a distance from element of 18 inches (460 mm).

- B. Installation of Felt Underlayment: Install felt underlayment and building-paper slip sheet on nailbase surface under sheet metal roofing.
 - 1. On nailbase for roofing, apply from eave to ridge and at locations indicated, in shingle fashion to shed water, with lapped joints of not less than 2 inches (51 mm) at sides and 4 inches (102 mm) at ends.
 - a. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under sheet metal roofing.
 - b. Apply slip sheet over building felt underlayment before installing sheet metal roofing or siding.

3.6 STANDING SEAM SHEET METAL ROOFING AND SIDING INSTALLATION

- A. Seam Construction, General:
 - 1. Install sheet metal roofing and siding to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated.
 - 2. PATinated Copper: Use copper fasteners only.
 - 3. Seam Types: Continuous double-locked parallel standing seams and right angled offset cleated flat seams.
 - a. Standing Seams: The locked portion of the standing seam shall be 5-ply in thickness. Terminate standing seam at flat areas by turning down in a tapered fold or as indicated.
- B. Installation of Standing Seam Sheet Metal Roofing and Siding:
 - 1. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
 - 2. Provide metal closures as shown on Drawings, designed to allow ventilation below sheet metal while preventing entry of water, at peaks, rake edges, rake walls and each side of ridge and hip caps.
 - 3. Provide expansion cleats in roof panels that exceed 30 feet (9.1 m) in length.
 - 4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 - 5. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 6. Install ridge and hip caps as sheet metal roofing work proceeds.
 - 7. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.
 - 8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.
 - 9. Construct panels and seams at ridges, hips, valleys and eaves in strict accordance with details in SMACNA's "Architectural Sheet Metal Manual".

3.7 SHEET METAL FLASHING AND TRIM INSTALLATION, GENERAL

- A. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- B. 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.

- C. 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 (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) 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 (25 mm) deep, filled with elastomeric sealant concealed within joints.
- E. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
 - 1. Zinc-Tin Alloy-Coated Copper: Use copper fasteners only.
- F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.
 - 1. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
 - 2. 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.

3.8 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. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 16-inch (400-mm) centers.
- C. 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.
- D. 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 (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
 - 1. Secure in a waterproof manner by means of snap-in installation and sealant or lead

wedges and sealant.

- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
 - 2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.9 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, mechanical, electrical, and louvers.
- B. Through-Wall Flashing: Installation of formed through-wall flashing in masonry is specified in Section 042000– Unit Masonry Assemblies.
- C. Reglets: Installation of reglets is specified in Section 042000 – Unit Masonry Assemblies.
- D. Openings Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings, or further as shown on Drawings.

3.10 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 sheet metal roofing assembly including trim, copings, ridge closures, 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).
- C. Pipe and Penetration Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.

- D. Roof Curbs: Install curbs at locations indicated on Drawings. Set roof curb so top surface of roof curb is level. Install flashing around bases where they meet sheet metal roofing.
- E. Bar-Type Snow Guards: Attach bar supports to vertical ribs of standing-seam sheet metal roofing with clamps or setscrews. Do not use fasteners that will penetrate sheet metal roofing.
- F. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.
- G. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored gutter brackets or straps spaced not more than 36 inches apart. Provide end closures and seal watertight with sealant. Slope to downspouts.
 - 1. Fasten gutter spacers to front and back of gutter.
 - 2. Loosely lock straps to front gutter bead and anchor to roof deck.
 - 3. Anchor and loosely lock back edge of gutter to continuous cleat.
 - 4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
 - 5. Anchor gutter with spikes and ferrules spaced not more than 24 inches apart.
 - 6. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.
- H. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 - 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
 - 2. Connect downspouts to underground drainage system indicated.
- I. Splash Blocks: Install where downspouts discharge onto low-slope roofs and where indicated. Set in cement or sealant compatible with roofing membrane.

3.11 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.
- 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 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 access hatches.
 - 2. Hatch-type heat and smoke vents.
 - 3. Elevator vents.
- B. 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 cants and wood nailers
 - 2. Section 076200 - SHEET METAL FLASHING AND TRIM for shop- and field-fabricated metal flashing and counterflashing, and miscellaneous sheet metal trim and accessories.
 - 3. Section 230000 - HEATING, VENTILATING, AND AIR CONDITIONING for roof-mounted ventilators.

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. 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 Ciera 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: Aluminum sheet, minimum 0.090 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.
 - 11. Safety Railing System: Manufacturer's standard safety railing system; Rail : 1-5/8" OD A53 grade B seamed galvanized steel w/ zinc plated post caps; Base is factory galvanized 2"x2" 16 gauge seamed steel with cast steel hot dipped galvanized clamps. Include self closing, rigid steel gate.
 - a. Finish: Manufacturer's standard finish in color as selected by Architect.

2.2 ELEVATOR VENT

- A. Elevator Hoistway Penthouse Vent: Provide louvered penthouse assemblies with automatic dampers, complying with the following:
1. Available Manufacturers:
 - a. Airolite 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 HEAT AND SMOKE VENTS

- A. Hatch-Type Heat and Smoke Vents: Manufacturer's standard hatch-type heat and smoke vents with integral double-wall insulated curbs and frame, with welded or sealed mechanical corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-wall lid, continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms, UL-listed resetting fusible links rated at 165 deg F and corrosion-resistant or hot-dip galvanized hardware including hinges, hold-open devices, and independent manual-release devices for inside and outside operation of lids.
1. Available Manufacturers:
 - a. Bilco.
 - b. Babcock Davis.
 - c. Nystrom.
 - d. Approved equal.
 2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads. a. When release is actuated, lid shall open against 10-lbf/sq. ft. snow or wind load and lock in position.
 3. Type: Double door.
 4. Regulatory Requirements: UL 793 and NFPA 204.
 5. Heat and Smoke Vent Compliance: Provide units that have been tested and UL listed.
 6. Fire Resistance of Lids: UL Class A rating.
 7. Integral Curb, Framing & Lid Material: Cover and curb, 11-gauge aluminum.
 8. Insulation: 3 inches fiberglass insulated curbs with integral cap flashing
 9. Fabricate integral curbs to minimum height of 12 inches unless otherwise indicated.
 10. Aluminum Mill Finish: Powder coat paint in color as selected by Architect from manufacturer's full range.
 11. Size: 96 inches by 60 inches, unless otherwise noted.
 12. Voltage: Provide 24 volt dc with resettable link and coordinate with fire alarm system.
 13. Hardware: Provide stainless steel hardware.
 14. STC: 46 – 48.
 15. Electrical Actuator: Provide manufacturer's electrically operated automatic actuator.
 16. Basis of Design. Bilco Type ACDSH Series Fire Vent.

2.4 MISCELLANEOUS MATERIALS

- A. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, complying with AWPA 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 (if any) 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. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.
 - G. 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. Heat and Smoke Vent Installation: Locate, install, and test heat and smoke vents according to NFPA 204.
 - 1. Check heat and smoke vent for proper operation. Adjust operating mechanism as required.
 - G. 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.
- 3.3 TOUCH UP
- A. Touch up factory-finished surfaces with compatible finish.
 - 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.
- 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 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. Related Work: The following items are not included in this Section and will be performed 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 053100 - STEEL DECKING for surface conditions required for steel decking receiving sprayed fire-resistive materials.
 - 5. Section 078400 - FIRESTOPPING for firestopping and firesafing insulation.
 - 6. Section 092900 - GYPSUM BOARD ASSEMBLIES for fire-resistance-rated assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Structural framing and decking 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.
- C. 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.
- D. Qualification Data: For Installer, manufacturer, and testing agency.
- E. IAQ Submittals: For each product that contains VOC's, or is otherwise regulated under OSHA Hazard Communication Standard 1610.1200, comply with submittal requirements specified in Section 018119 – INDOOR AIR QUALITY REQUIREMENTS.
- 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. Carbolite Co., Fireproofing Products Div.; Pyrolite 15.
 - b. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type MK-6/HY.
 - c. Isolatek International Corp., Cafco Products; Cafco 300.
 - d. Southwest Vermiculite Co., Inc.; 5EF.
 - e. A/D Fire Protection Systems Type 5GP.
- 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 AWCI 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 and 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

- 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. Carbolite Co., Fireproofing Products Div.; Pyrocrete 239.
 - b. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type Z106.
 - c. Isolatek International Corp., Cafco Products.; Cafco 400.
 - d. Pyrok, Inc.; Pyrok-MD.
 - e. Southwest Vermiculite Co., Inc.; 7GP.
 - f. A/D Fire Protection Systems; Type 7GP.

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. Carboline Co., Fireproofing Products Div.; Pyrocrete 40.
 - b. Grace, W. R. & Co.--Conn., Construction Products Div.; Monokote Type Z146.
 - c. Isolatek International Corp., Cafco Products.; Fendolite MII.
 - d. Pyrok, Inc.; Pyrok-HD.
 - e. Southwest Vermiculite Co., Inc.; 7HD.
 - f. A/D Fire Protection Systems; Type 7HD.

2.4 INTUMESCENT MASTIC FIRE-RESISTIVE COATINGS

- A. General, 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.

- B. Thin-Film Fire-Resistive 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., 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 II and Colorcoat.
 - b. Albi Manufacturing, Division of StanChem Inc.; Albi Clad TF.
 - c. Carboline Co., 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., 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.

C. Color and Gloss: As selected by Architect from manufacturer's full range.

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.
 1. Provide cleaning and other preparation work as required to comply with manufacturer's recommendations for surface preparation.
- 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 078400

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.
- 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 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, except where indicated to be by another trade.
 - 2. Fire-resistive joint systems for floor, wall, and head-of-wall joints.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 079200 - JOINT SEALANTS for standard joint sealers.
 - 2. Section 210001 - FIRE PROTECTION for firestopping of fire-suppression piping penetrations.
 - 3. Section 220001 - PLUMBING for firestopping of piping penetrations.
 - 4. Section 230001 - HEATING, VENTILATING AND AIR CONDITIONING for firestopping of duct and piping penetrations.
 - 5. Section 260001 - ELECTRICAL WORK for firestopping of cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

- 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 PERFORMANCE REQUIREMENTS FOR FIRE-RESISTIVE JOINT SYSTEMS

- 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.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system and fire-resistive joint system, show each type of construction condition penetrated and in which joints are installed, 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.
- C. 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.
- D. Qualification Data: For Installer.
- E. Field quality-control test reports.

- F. Research/Evaluation Reports: For each type of fire-resistive joint system.
- G. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

1.6 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 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 firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide 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. 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. Firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver 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 firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install firestop systems when ambient or substrate temperatures are outside limits permitted by firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of joints, openings and penetrating items to ensure that firestop systems are installed according to specified requirements.
- B. Coordinate sizing of joints, sleeves, openings, core-drilled holes, or cut openings to accommodate firestop systems.
- C. Do not cover up firestop system installations that will become concealed behind other construction until each installation has been examined by the 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. 3M; Fire Protection Products Division.
 - 4. WR Grace and Co.; FlameSafe, equal products.
 - 5. Or approved equal.

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 FIRE-RESISTIVE JOINT SYSTEMS

- A. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- B. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- 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.

2.4 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 joint configurations, 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 joints and openings immediately before installing firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of joint and opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean joint and 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 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 FIRE-RESISTIVE JOINT 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.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified, independent inspecting agency to inspect firestop systems. 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 firestop systems so they comply with requirements.
- C. Proceed with enclosing firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 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 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 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.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE (BEGINNING ON FOLLOWING PAGE)

A. THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

CONCRETE FLOORS		UL-CLASSIFIED SYSTEMS			CONCRETE OR BLOCK WALLS		UL-CLASSIFIED SYSTEMS		
TYPE OF PENETRANT	F-RATING HR	HILTI	3M	BIO-FIRE	TYPE OF PENETRANT	F-RATING	HILTI	3M	BIO-FIRE
CIRCULAR BLANK OPENINGS	1	FA 0006, CAJ 0070	CAJ 0009	CAJ 0056	CIRCULAR BLANK OPENINGS	1	CAJ 0055, CAJ 0070	CAJ 0009	CAJ 0056
	2	FA 0006, CAJ 0070	CAJ 0009	CAJ 0056		2	CAJ 0055, CAJ 0070	CAJ 0009	CAJ 0056
	3	CAJ 0055	CAJ 0009	CAJ 0056		3	CAJ 0055	CAJ 0009	CAJ 0056
SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, CAJ 1278, FA 1017	CAJ 1058	CAJ 1264	SINGLE METAL PIPES OR CONDUIT	1	CAJ 1226, CAJ 1278,	CAJ 1058	CAJ 1264
	2	CAJ 1226, CAJ 1278, FA 1017	CAJ 1058	CAJ 1264		2	CAJ 1226, CAJ 1278,	CAJ 1058	CAJ 1264
	3	CAJ 1226, CAJ 1278, FA 1017	CAJ 1058	CAJ 1264		3	CAJ 1226, CAJ 1278,	CAJ 1058	CAJ 1264
	4	CAJ 8095, CBJ 1034	CAJ 1044	N/A		4	CAJ 8095, CBJ 1034, WJ 1042	CAJ 1044	WJ 1064
SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, ENT)	1	CAJ 2109, CAJ 2168, FA 2054, FA 2067	CAJ 2189, CAJ 2117, CAJ 2027	CAJ 2131	SINGLE NON-METALLIC PIPE OR CONDUIT (I.E. PVC, CPVC, ABS, ENT)	1	CAJ 2109, WJ 2108, WJ 2121	CAJ 2189, CAJ 2117, CAJ 2027	CAJ 2131
	2	CAJ 2109, CAJ 2168, FA 2054, FA 2067	CAJ 2189, CAJ 2117	CAJ 2131		2	CAJ 2109, WJ 2108, WJ 2121	CAJ 2189, CAJ 2117, CAJ 2027	CAJ2131
	3	CAJ 2109, CAJ 2168, FA 2054,	CAJ 2005, CAJ 2117	CAJ 2152		3	CAJ 2109, CAJ 2168, WJ 2091	CAJ 2005, CAJ 2117, CAJ 2027	CAJ2152
	4	N/A*	N/A*	N/A		4	WJ 2091	N/A*	N/A

SINGLE OR BUNDLED CABLES	1	FA 3007, CAJ 3095,	CAJ 3021	CAJ 3103	SINGLE OR BUNDLED CABLES	1	CAJ 3095, WJ 3060 WJ 3074	CAJ 3021	WJ 3071
	2	FA 3007, CAJ 3095,	CAJ 3021	CAJ 3103		2	CAJ 3095, WJ 3060 WJ 3074	CAJ 3021	WJ 3071
	3	FA 3007, CAJ 3095,	CAJ 3030	CAJ 3103		3	CAJ 3095, WJ 3050	CAJ 3030	CAJ 3103
	4	N/A*	N/A*	N/A		4	WJ 3050	N/A*	N/A
CABLE TRAY	1	CAJ 4034, CAJ 4054, CAJ 4017	CAJ 4003	CAJ 4048	CABLE TRAY	1	CAJ 4034, CAJ 4054, WJ 4016,	CAJ 4003	CAJ 4048
	2	CAJ 4034, CAJ 4054, CAJ 4017	CAJ 4003	CAJ 4048		2	CAJ 4034, CAJ 4054, WJ 4016,	CAJ 4003	CAJ 4048
	3	CAJ 4034, CAJ 4017	CAJ 4003	CAJ 4048		3	CAJ 4034, WJ 8007	CAJ 4003	CAJ 4048
	4	N/A*	N/A*	N/A		4	WJ 8007	N/A*	N/A
SINGLE INSULATED PIPES	1	FA 5016, FA 5017, CAJ 5090, CAJ 5091,	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082	SINGLE INSULATED PIPES	1	CAJ 5090, CAJ 5091, WJ 5042	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082
	2	FA 5016, FA 5017, CAJ 5090, CAJ 5091,	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082		2	CAJ 5090, CAJ 5091, WJ 5042	CAJ 5080, CAJ 5024, CAJ 5017	CAJ 5082
	3	FA5016, CAJ 5061, CAJ 5090,	CAJ 5024, CAJ 5017	CAJ 5006		3	CAJ 5090, CAJ 5091,	CAJ 5024, CAJ 5017	CAJ 5006
	4	CBJ 5006	N/A*	N/A		4	WJ 5028, CBJ 5006	N/A*	N/A
ELECTRICAL BUSWAY	1	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6026	ELECTRICAL BUSWAY	1	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6026
	2	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6026		2	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	CAJ 6026
	3	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	N/A		3	CAJ 6006, CAJ 6017	CAJ 6001, CAJ 6002	N/A

NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046 CAJ 7051	CAJ 7003, CAJ 7021	CAJ 7036	NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	CAJ 7046, WJ 7029, WJ 7022	CAJ 7003, CAJ 7021	CAJ 7036
	2	CAJ 7046 CAJ 7051	CAJ 7003, CAJ 7021	N/A		2	CAJ 7046, WJ 7029, WJ 7022	CAJ 7003, CAJ 7021	CAJ 7036
	3	CAJ 7046 CAJ 7051	CAJ 7003, CAJ 7021	N/A		3	CAJ 7046 CAJ 7051	CAJ 7003, CAJ 7021	N/A
MIXED PENETRANTS	1	CAJ 8056, CAJ 8095, CAJ 8099	CAJ 8001, CAJ 8013	CAJ 8051	MIXED PENETRANTS	1	CAJ 8096, CAJ 8099 WJ 8007	CAJ 8001, CAJ 8013	CAJ 8051
	2	CAJ 8056, CAJ 8095, CAJ 8099	CAJ 8001, CAJ 8013	CAJ 8051		2	CAJ 8096, CAJ 8099 WJ 8007	CAJ 8001, CAJ 8013	CAJ 8051
	3	CAJ 8056, CAJ 8095, CAJ 8099	CAJ 8001, CAJ 8013	CAJ 8051		3	CAJ 8099 WJ 8007	CAJ 8001, CAJ 8013	CAJ 8051
	4	CAJ 8095	N/A*	N/A		4	WJ 8007	N/A*	N/A

WOOD FLOORS		UL-CLASSIFIED SYSTEMS			GYPSUM WALLBOARD ASSEMBLIES		UL-CLASSIFIED SYSTEMS		
TYPE OF PENETRANT	F-RATING	HILTI	3M	BIO-FIRE	TYPE OF PENETRANT	F-RATING	HILTI	3M	BIO-FIRE
METAL PIPES OR CONDUIT	1	FC 1009, FC 1059	FC 1002	FC 1031	METAL PIPES OR CONDUIT	1	WL 1054, WL 1164	WL 1146	WL 1115
						2	WL 1054, WL 1164	WL 1010, WL 1146	WL 1115
	2	FC 1009, FC 1059	FC 1002	FC 1031		4	WL 1110	WL 1001	
NON-METALLIC PIPE OR CONDUIT	1	FC 2025, FC 2126	FC 2024	FC 2059	NON-METALLIC PIPE OR CONDUIT	1	WL 2078, WL 2075, WL 2128	WL 2088, WL 2002	WL 2133
						2	WL 2078, WL 2075, WL 2128	WL 2088, WL 2002	WL 2133
	2	FC 2025, FC 2126	FC 2024	FC 2059		4	WL 2184, WL 2245	N/A*	
SINGLE OR BUNDLED CABLES	1	FC 3012, FC 3044	FC 3017	FC 3050	SINGLE OR BUNDLED CABLES	1	WL 3065	WL 3032, WL 3030	WL 3153
						2	WL 3065	WL 3032, WL 3030	WL 3153
						4	WL 3139	N/A*	
	2	FC 3012	FC 3017	N/A	CABLE TRAY	1	WL 4011, WL 4019	WL 4004	WL 4032
						2	WL 4011, WL 4019	WL 4004	WL 4032
						4	WL 8014	N/A*	
INSULATED PIPES	1	FC 5004, FC 5036, FC 5037	FC 5014	FC 5025	INSULATED PIPES	1	WL 5029, WL 5096	WL 5040, WL 5001, WL 5032	WL 5062
						2	WL 5029, WL 5096	WL 5040, WL 5001, WL 5032	WL 5062
	2	FC 5004	N/A*	FC 5025		4	WL 5073	N/A*	
						4	WL 5073		

NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	FC 7013	FC 7001		NON-INSULATED MECHANICAL DUCTWORK WITHOUT DAMPERS	1	WL 7040, WL 7042	WL 7008	WL 7037
						2	WL 7040, WL 7042	WL 7008, WL 7013, WL 7016	WL 7037
						4			
MIXED PENETRANTS	1	FC 8014, FC 8026	FC 8013	N/A	MIXED PENETRANTS	1	WL 8004, WL 8013	WL 8010	WL 8017
						2	WL 8004, WL 8013	WL 8010, WL 8002	WL 8017
	2	N/A*	N/A*	N/A		4	WL 8014	N/A*	
						4	WL 8014		

* No UL-Classified system is available as of August 2003. Engineer Judgement 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 Judgement 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 judgement 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.

3.8 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	3M	BIO-FIRESHIELD	HILTI	3M	BIO-FIRESHIELD
CONCRETE FLOOR-TO-FLOOR	1	see note 2	FF-D-0002	N/A**	FF-D-1026, FF-D-1039	FF-D-1002, FF-D-1003, FF-D-1004	N/A**
	2	see note 2	FF-D-0002	N/A**	FF-D-1026, FF-D-1039	FF-D-1002, FF-D-1003, FF-D-1004	N/A**
	3	see note 2	N/A**	N/A**	FF-D-1026, FF-D-1039	N/A**	N/A**
EDGE OF CONCRETE FLOOR SLAB-TO-WALL (also	1	see note 2	-	N/A**	FW-D-1011, FW-D-1012, FW-D-1013,	FW-D-1002, FW-D-1003, FW-D-1009	FW-D-1023

see CURTAIN WALLS & note 1))					FW-D-1021		
	2	see note 2	-	N/A**	FW-D-1011, FW-D-1012, FW-D-1013, FW-D-1021	FW-D-1002, FW-D-1003, FW-D-1009	FW-D-1023
	3	see note 2	-	N/A**	FW-D-1011, FW-D-1021	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-0023, HW-D-0029	HW-D-0114	HW-D-1008, HW-D-1009	HW-D-1003	HW-D-1023
	2	HW-D-0097	HW-D-0023, HW-D-0029	HW-D-0114	HW-D-1008, HW-D-1009	HW-D-1003	HW-D-1023
	3	see note 2	-	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-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-0022, HW-D-0030, HW-D- 0040HW-D- 0013	HW-D-0200	HW-D- 1037	HW-D 1041	N/A**
	3	N/A**	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-0012, HW-D-0021	HW-D-0180	N/A**		
	2	HW-D-0082, HW-D-0083, HW-D-0097	HW-D-0012, HW-D-0021	HW-D-0180	N/A**		
	3	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-0011, HW-D-0020, HW-D-0031	HW-D-0033	N/A**		
	2	HW-D-0042, HW-D-0049, HW-D-0076, HW-D-0264	HW-D-0011, HW-D-0020, HW-D-0031	HW-D-0033	N/A**		
	3	HW-D-292	N/A**	N/A**	N/A**		
CONCRETE WALL- TO-WALL	1	WW-D-0017, WW-D-0032	-	WW-D-0009	WW-D-1011, WW-D-1012	WW-D-1003, WW-D-1004, WW-D-1010	N/A**
	2	WW-D-0017, WW-D-0032	-	WW-D-0009	WW-D-1011, WW-D-1012	WW-D-1003, WW-D-1004, WW-D-1010	N/A**
	3	-	-	WW-D-0010	WW-D-1011	WW-D-1003, WW-D-1010	N/A**
CURTAIN WALLS (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 In- tegrity Rating	CW-D-2027			CW-D-2026, CW-D-2027		CW-D-2019, CW-D-2015
EDGE OF FLOOR TO NON-RATED CONCRETE/STONE SPANDREL	2 hr In- tegrity Rating	CW-D-1001			CW-D-2025		CW-D-2017

** 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 FIREPROOFING MATERIALS WITHIN THE JOINT.
CONSULT INDIVIDUAL DETAILS FOR SPECIFICATIONS & LIMITATIONS.
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 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. Furnish all materials, equipment, labor and services required for all caulking and sealant work as specified herein as indicated on Drawings, or both.
- B. The Work of this Section includes, but is not limited to, the following:
 - 1. Caulking, sealants, joint backup and associated primers at exterior and interior locations.
 - 2. Caulking expansion joints in exterior concrete pavement.
 - 3. Field testing of all caulking materials.
- C. Include sealant at all exterior and interior perimeter sealing of windows, curtainwall and louvers; sealant at exterior vertical control joints; perimeter exterior sealing where mechanical, plumbing, electrical and fire protection work penetrates the exterior wall; sealant at exterior paving and curbing; sealant at joint between site improvements and concrete pavement; sealant at expansion joints in concrete paving; interior perimeter sealing of transitions between masonry and gypsumboard; sealant at perimeter of all interior steel frames in masonry walls; sealant at joints between plumbing fixtures and adjacent construction; sealant at interior joint between slab-on-grade to foundation wall and to columns; and sealants at other locations indicated.

1.3 RELATED WORK UNDER OTHER SECTIONS

- A. Related Work: The following items are not included in this Section and will be performed 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 092900 - GYPSUM BOARD ASSEMBLIES for acoustic sealants and materials.
4. Section 095100 - ACOUSTICAL PANEL CEILINGS for sealing edge moldings at perimeters of acoustical ceilings.
5. Section 064020 – INTERIOR ARCHITECTURAL WOODWORK, for sealants required by work of that section.
6. Section 114000 – FOODSERVICE EQUIPMENT, for sanitary sealants at food service equipment.
7. Section 087100 – DOOR HARDWARE for sealant under door thresholds.
8. Section 093000 – TILING, for sealants provided by tiling trade.
9. Section 123000 – MANUFACTURED CASEWORK, for sealants required by work of that section.

1.4 INDOOR AIR QUALITY 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. 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 sealant primer for non-porous surfaces: Maximum 250 grams/liter total VOC's.
 2. Architectural sealant primer for porous surfaces: Maximum 775 grams/liter total VOC's.
 3. Architectural sealant: Maximum 250 grams/liter total VOC's.
 4. Adhesive materials: Maximum 250 grams/liter total VOC's.
- C. No product specified in this section for interior installation shall contain aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium or hexavalent chromium.

1.5 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300– Submittals.
- B. Product Data: Submit manufacturer's product description, performance and test data on all materials.
- C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
 1. Include manufacturer's statement that product is compatible with each substrate to

which it will be applied, and that it will adhere and perform as specified.

D. Samples:

1. Concealed and colorless sealant: Sealant samples shall be 3" strips joining wood, metal or hardboard. Joint backup sample shall be 6" long 1/2" or greater diameter.
2. Exposed colored sealant: Colors of all materials shall be as selected by the Architect. Submit samples of manufacturer's full range of colors for color selection. Where indicated herein that custom colors may be required, sealant colors shall be specially formulated to match adjacent concrete, masonry or metal finish, or other cladding material.

1.6 QUALITY ASSURANCE

- A. Materials used in fulfilling the requirements of this Section shall be suitable for each intended use and shall be of the type specified for each category. Materials shall be applied under temperatures required for each type in accordance with the manufacturer's recommendations.
- B. In addition to other requirements, compounds shall contain no acid or ingredient that will affect masonry, corrode metal, or have injurious effects on paint.
- C. Use proper materials specified herein for each location whether Drawings call for "Caulking" or "Sealant".
- D. Submit manufacturer's certification of compliance with these specifications for each material.
- E. Joint Sealant Barrier Mock-ups:
 1. Provide joint sealants for mock-ups.
 2. Refer to Section 072500 – Air and Vapor Barrier for additional requirements for air/vapor barrier mock-up.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Each container shall bear an unbroken seal, test number and label of the manufacturer upon delivery at the site. Unlabeled materials will be rejected and shall be removed from the site and replaced with approved labeled materials at no additional cost to the Owner.
- B. Deliver materials to site and install work under this Section in ample time to avoid delay in job progress and at such times as to permit proper coordination of the various parts.

1.8 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 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 JOINT SEALANT MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another, will maintain adhesion and will not deteriorate material in which the sealant is in contact, and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

2.3 ELASTOMERIC SEALANTS FOR EXTERIOR APPLICATIONS

- A. Polyurethane Exterior Deck Sealant: Pourable grade, self-leveling, one-component, polyurethane-based, elastomeric sealant
1. Requirements: Comply with the following:
 - a. Federal Specification TT-S-00230C, Class A, Type 1
 - b. ASTM C 920, Type S, Grade P, Class 25 min., Use T, M, A and O.
 - c. Shore Hardness: 30, minimum
 2. Locations: At expansion and control joints in exterior horizontal surfaces in concrete pavement.
 3. Product:
 - a. Basis of Design: Pecora Corporation, *Urexpan NR-201*.
 - b. Tremco, *Vulkem 45 SSL*.
 - c. Sika, *Sikaflex-1c SL*.
 - d. Approved equal.

4. Colors: As selected by Architect from manufacturers full range.

B. 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. Basis of Design: Pecora Corporation, *890 FTS Field tintable silicone sealant*.
 - b. Tremco Inc.; *Spectrem 4TS Field tintable silicone sealant*.
 - c. Dow Corning Corporation; *790*.
 - d. Approved equal.
2. Locations: Joints in exterior vertical and soffit and ceiling surfaces.
3. Custom colors may be required and shall be selected by the Architect to match or contrast with adjacent materials. Multiple colors may be required within the same surface so as to match or contrast with multiple colors of abutting cladding and fenestration materials.

2.4 ELASTOMERIC SEALANTS FOR INTERIOR APPLICATIONS

A. Silicone Interior Deck Sealant: Pourable-grade, self-leveling, one-part, low-modulus, cold-applied silicone sealant.

1. Requirements:
 - a. ASTM D-5893-96, Type SL.
2. Locations: At joint between slab-on-grade perimeter to foundation and at joint around column penetrations through slab-on-grade and elsewhere as may be indicated on drawings.
3. Product:
 - a. Basis of Design: Pecora, *300 SL Self-Leveling Pavement Joint Sealant*.
 - b. Dow Corning, *890 SL Sealant*.
 - c. Tremco, *Spectrem 900 SL Self-Leveling Highway Sealant*.
 - d. Approved equal.
4. Provide colors as selected by Architect from manufacturer's standard range.

B. Interior Sanitary Sealant: One-part, mildew-resistant, non-sagging silicone sealant.

1. Requirements: Shore A hardness of 25, meeting ASTM C-920, Type S, Grade NS, Class 25, Use NT.
2. Locations: For non-moving joints in bathrooms, and other wet areas, including joints between plumbing fixtures and adjacent construction.
3. Product:
 - a. Basis of Design: Pecora, *898 NST*.
 - b. Dow Corning, *786 Mildew Resistant Sealant*
 - c. Tremco, *Tremsil 600*
 - d. Approved equal.
4. Colors shall be selected by the Architect from manufacturer's standard colors to match adjacent materials.

2.5 OTHER SEALANT MATERIALS

- A. Interior Latex Sealant: Paintable acrylic latex sealant formulated to provide a fast-setting pliable seal with minimal shrinkage.
 - 1. Requirements: Meet all requirements of ASTM C834.
 - 2. Locations: For interior joints with small movement. Sealant shall be paintable.
 - 3. Product:
 - a. Basis of Design: Pecora, *AC-20 Plus Silicone*.
 - b. BASF - Sonneborn, *Sonolac*.
 - c. Tremco, *Tremflex 834*.
 - d. Approved equal.

2.6 PRIMER AND BACKER ROD

- A. Primer: Sealant primers, where required, shall be low-VOC, liquid type recommended by the sealant manufacturer for each use.
- B. Backer Rod:
 - 1. Type: Closed-cell, non-absorbent, polyethylene foam or open/closed cell polyethylene or polyolefin foam backer rod, as recommended, preferred or required by the sealant manufacturer for each type of sealant. Reticulated polyethylene or polyolefin may be used only where accepted by manufacturer for each type of sealant. Do not use vinyl foam stock.
 - 2. Size: As selected for each application to provide approximately 33% compression when in place.
 - 3. Location: Use backer rod at all interior and exterior joints where required to comply with manufacturer's recommended joint depths.
 - 4. Product:
 - a. Nomaco Engineered Foam Solutions; HBR Closed-cell Backer-Rod or SOF Rod Bi-Cellular Backer-Rod.
 - b. Industrial Thermo Polymers, Ltd; ITP Standard Closed-cell Backer-Rod (101) or ITP Soft-Type Backer-Rod (104).
 - c. BASF-Sonneborn; Closed-cell Backer-Rod or Soft Backer-Rod.

2.7 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.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manu-

facturer 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. Additionally, provide bond-breaker tape at various locations where space is too limited for a traditional backer rod. Locations include but are not limited to: interior concrete slab, perimeter and column penetration joints, exterior concrete expansion joints and elsewhere where required to prevent three sided adhesion.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before starting work, inspect all surfaces to receive sealant work and report in writing to the Architect any surfaces that are not suitable for application of such materials.
- B. Surfaces to receive sealants shall be structurally sound, clean, dry and free of all materials that prohibit bonding of new products to the substrate. Materials to be removed include but are not limited to: oil, dust and loose particles.
- C. Any new cementitious or plaster substrates shall be fully cured prior to application of new materials.
- D. Unsuitable surfaces shall be corrected before work begins. Commencement of material application to any surface shall constitute acceptance of that surface as proper to receive work under this Section. Subsequent defects in work shall be corrected under this Section without additional cost to the Owner.

3.2 PREPARATION FOR SEALANTS

- A. Notify the proper trades of locations where adequate rabbets for sealant have not been provided; all such rabbets shall be prepared by cutting and cleaning out material to the minimum depth required and by grinding to the minimum width by the appropriate trade.
- B. Wire brush full depth of joints in concrete, masonry, mortar and plaster as required to obtain firm, clean surface. Clean metal surfaces where required to remove scale and other deposits and wipe clean with a mild, non-staining solvent. Clean other surfaces by methods approved by the sealant manufacturer. Where joint has been mortar-filled, rake out existing mortar to depth required for the joint width.
- C. Prime surfaces to receive sealing compounds where recommended by manufacturer in accordance with manufacturer's printed instructions.
- D. Install continuous lengths of joint backing material in proper size, shape and depth.
 - 1. Typical: Except where otherwise specified or recommended by manufacturer, depth of joints not exceeding 1/2" in width shall be approximately the same as the width.
 - 2. Wide joints: Joints exceeding 1/2" in width up to 1" in width shall have a depth of approximately 1/2 the width of the joint. For joints wider than 1" in width, review manufacturer's requirements and submit for review and approval by the Architect.
 - 3. Joint depth limits: No sealed joint shall be less than 1/4" deep, nor more than 1/2" deep.

- E. Install joint backup in all exterior joints in excess of 5/8 inch deep, and in all interior joints requiring backup, placing the bead in the joint in a manner that will assure constant caulking material depth. Set bead into joint continuously by slightly stretching during placement to permit compression against sides of joint without surface wrinkles or buckles.

3.3 FIELD QUALITY CONTROL

- A. Perform field tests on each sealant material as recommended by manufacturer. Minimum testing shall include:
 - 1. Skin-over Time/Elastomeric Test: Perform test on each new lot of sealant, but no less frequently than once per week, to verify that sealant material will cure fully and that shelf-life has not expired.
 - 2. Field Adhesion Hand Pull Test: Perform test of each sealant on each substrate, after sealant has cured fully. Perform no less than ten tests for the first thousand feet of application and at least one test per floor on each elevation, to verify that sealant material will adhere to all substrates. Repair tested sealant area as required.

3.4 SEALANT APPLICATION

- A. Installation Sequence: Where possible for any given interior area of the building, schedule application of all VOC-emitting sealants to precede installation of finishes with adsorptive surfaces. Refer to Section 018119 – Indoor Air Quality Control for additional requirements.
- B. Apply sealant only to clean, dry surfaces, and only when the ambient temperature is within manufacturer's recommended range.
- C. Application shall be in strict accordance with manufacturer's printed instructions.
- D. Apply gun grade sealants with caulking guns of type approved by sealant manufacturer using nozzles sized to fit into joints and drive material with sufficient pressure to fill all voids. Install sealant in continuous, uninterrupted, full length beads. Superficial pointing of joints with a thin bead of compound will not be acceptable.
- E. Apply pouring grade sealant at horizontal and deck joints in accordance with manufacturer's recommendations over joint backing. Joints shall be continuously filled, level and smooth.
- F. Neatly point and tool all finished joints concave, uniformly smooth and free of wrinkles, waves, sag lines and other imperfections. Keep outer edge of sealant 1/8" back from face of surrounding material. Remove masking tape immediately after tooling but before sealant has set.
- G. Surfaces of all materials adjoining caulked joints shall be fully protected and be kept clean and free of smears of compound and other soiling due to sealant application. Use non-staining masking tape as required.

3.5 PROTECTION AND CLEANING

- A. Protect uncured sealant after installation from dust, atmospheric dirt and debris.

- B. Clean all surfaces of adjacent surfaces that have been marked or soiled by the work of this Section, removing all excess materials therefrom. Use only cleaning materials and solvents that will not damage the surfaces in any way.
- C. Remove all debris and rubbish as the work progresses, and legally dispose of same.
- D. At completion of work, do final cleaning, leaving the work and adjacent surfaces in a clean and neat condition.

END OF SECTION

SECTION 079500

EXPANSION CONTROL

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 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 expansion joint systems for interior joints as scheduled on the Drawings and specified in this Section.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for block-outs for architectural joint systems in concrete floors, decks, and walls.
 - 2. Section 079200 - JOINT SEALANTS for elastomeric sealants and preformed compressed-foam sealants without metal frames.

1.3 DEFINITIONS

- A. Architectural Joint System: Any filler or cover used to span, fill, cover, or seal a joint, except expanding foam seals and poured or foamed in-place sealants.
- B. Cyclic Movement: Periodic change between widest and narrowest joint widths in an automatically mechanically controlled system.
- C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist passage of flame and hot gases through a movement joint.
- D. Maximum Joint Width: Widest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.
- E. Minimum Joint Width: Narrowest linear gap a joint system tolerates and performs its designed function without damaging its functional capabilities.

- F. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint opening typically expressed in numerical values (mm or inches) or a percentage of nominal value of joint width.
- G. Nominal Joint Width: Width of linear gap indicated as representing the conditions existing when architectural joint systems will be installed or, if no nominal joint width is indicated, a width equal to the sum of maximum and minimum joint widths divided by two.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide factory-fabricated architectural joint systems capable of withstanding the types of loads and of accommodating the kinds of movement, and the other functions for which they are designed including those specified below, without failure. Types of failure include those listed in Appendix X3 of ASTM E 1399.
 - 1. Pedestrian Traffic Joints: Support pedestrian traffic across joint.
 - 2. Joints in Fire-Resistance-Rated Assemblies: Maintain fire-resistance ratings of assemblies.
 - 3. Joints in Smoke Barriers: Maintain integrity of smoke barrier.
 - 4. Joints in Acoustically Rated Assemblies: Inhibit passage of airborne noise.
 - 5. Other Joints: Where indicated, provide joint systems that prevent penetration of water, moisture, and other substances deleterious to building components or content.
 - 6. Seismic Joints: Remain in place on exposure to seismic activity (movement).
 - 7. Joints in Surfaces with Architectural Finishes: Serve as finished architectural joint closures.

1.5 SUBMITTALS

- A. Product Data: Include manufacturer's product specifications, construction details, material and finish descriptions, and dimensions of individual components and seals.
- B. Shop Drawings: For each joint system specified, provide the following:
 - 1. Placement Drawings: Include line diagrams showing entire route of each joint system, plans, elevations, sections, details, joints, splices, locations of joints and splices, and attachments to other Work. Where joint systems change planes, provide Isometric Drawings depicting how components interconnect to achieve continuity of joint covers and fillers.
- C. Samples for Verification: Full-size units 6 inches long of each type of joint system indicated; in sets for each finish, color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
- D. Product Test Reports: From a qualified testing agency indicating architectural joint systems comply with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain architectural joint systems through one source from a single manufacturer. Coordinate compatibility with adjoining joint systems specified in other Sections.

- B. Fire-Test-Response Characteristics: Where indicated, provide joint systems incorporating fire barriers that are identical to those of assemblies tested for fire resistance per ASTM E 119 and ASTM E 814, including hose-stream test of vertical wall assemblies, by a testing and inspecting agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B 221, alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6 for sheet and plate.
 - 1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
- B. Stainless Steel: ASTM A 666, Type 304 with No. 4 Satin finish, unless otherwise indicated, for plates, sheet, and strips.
- C. Preformed Seals: Single or multicellular extruded elastomeric seals designed with or without continuous, longitudinal, internal baffles. Formed to be installed in frames or with anchored flanges, in color indicated or, if not indicated, as selected by Architect from manufacturer's standard colors.
- D. Strip Seals: Elastomeric membrane or tubular extrusions with a continuous longitudinal internal baffle system throughout complying with ASTM E 1783; used with compatible frames, flanges, and molded-rubber anchor blocks.
- E. Compression Seals: Preformed, elastomeric extrusions having internal baffle system complying with ASTM E 1612 in sizes and profiles indicated or as recommended by manufacturer.
- F. Preformed Cellular Foams: Nonextruded, low-density, crosslinked, nitrogen-blown ethylene-vinyl-acetate copolymer extruded, compressible foam.
- G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint.
- H. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, flexible moisture barrier and filler materials, drain tubes, lubricants, adhesives, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.2 ARCHITECTURAL JOINT SYSTEMS GENERAL

- A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
 - 1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
 - 2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.

3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.
4. Public Area Seals: Non-slip seals designed for installation on treads and risers and to lie flat with adjacent surfaces, and complying with ADA guidelines for public areas.

2.3 SEISMIC INTERIOR JOINT SYSTEMS

- A. General: Provide joint systems of design, basic profile, materials, and operation indicated. Provide units with the capability to accommodate joint widths indicated and variations in adjacent surfaces.
 1. Furnish units in longest practicable lengths to minimize number of end joints. Provide hairline mitered corners where joint changes directions or abuts other materials.
 2. Include closure materials and transition pieces, tee-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous joint systems.
 3. Frames for Strip Seals: Designed with semiclosed cavity that provides a mechanical lock for seals of type indicated.
- B. Architectural Joint System AJS-1: Metal frames and covers for interior pedestrian traffic joints.
 1. Basis-of-Design Product: Balco, Inc.; **NBR-4x1/8"**, or equal by an acceptable manufacturer.
 2. Nominal Joint Width: **4 inches (102 mm)**.
 3. Movement Capability: **100%**.
 4. Type of Movement Capability: **Seismic**.
 5. Exposed Cover Material: Aluminum with mill finish with recess for 1/8" resilient flooring.
 6. Exposed Frame Material: Same material and finish as exposed cover material.
 7. Moisture Barrier: Provide manufacturer's standard unit.
 8. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.
- C. Architectural Joint System AJS-2: Metal frames and covers for interior joints between floors and walls.
 1. Basis-of-Design Product: Balco, Inc.; **NBRL-4x1/8"**, or equal by an acceptable manufacturer.
 2. Nominal Joint Width: **4 inches (102 mm)**.
 3. Movement Capability: **100%**.
 4. Type of Movement Capability: **Seismic**.
 5. Exposed Cover Material: Aluminum with mill finish with recess for 1/8" resilient flooring.
 6. Exposed Frame Material: Same material and finish as exposed cover material.
 7. Moisture Barrier: Provide manufacturer's standard unit.
 8. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.
- D. Architectural Joint System AJS-3: Metal frames and covers for interior joints on walls and soffits.
 1. Basis-of-Design Products: Balco, Inc.; **6GW-4 and 6GWC-4**, or equal by an acceptable manufacturer.
 2. Nominal Joint Width: **4 inches (102 mm)**.
 3. Movement Capability: **100%**.
 4. Type of Movement Capability: **Seismic**.
 5. Exposed Cover Material: Aluminum with Class I, clear anodic finish.
 6. Exposed Frame Material: Same material and finish as exposed cover material.
 7. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction.

- E. Architectural Joint System AJS-4: Metal frames and covers for interior joints on acoustical ceilings.
 - 1. Basis-of-Design Product: Balco, Inc.; **ACW-4**, or equal by an acceptable manufacturer.
 - 2. Nominal Joint Width: **4 inches (102 mm)**.
 - 3. Movement Capability: **100%**.
 - 4. Type of Movement Capability: **Seismic**.
 - 5. Exposed Cover Material: Santoprene. Color as selected by Architect
 - 6. Support Frame: Aluminum clips screwed into ceiling tees.
 - 7. Fire-Resistance Ratings: Provide manufacturer's standard fire barrier with a rating not less than that of adjacent construction

2.4 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.

2.5 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. 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.

2.6 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. 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 PREPARATION

- A. Prepare substrates according to architectural joint system manufacturer's written instructions.
- B. Coordinate and furnish anchorages, Placement Drawings, and instructions for installing joint systems to be embedded in or anchored to concrete or to have recesses formed into edges of concrete slab for later placement and grouting-in of frames.

- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary to secure joint systems to in-place construction, including threaded fasteners with drilled-in expansion shields for masonry and concrete where anchoring members are not embedded in concrete. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.
- D. Provide the services of a surveyor licensed in the state the project is located prior to and after paving substrate to confirm alignment of joint.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for handling and installing architectural joint assemblies and materials, unless more stringent requirements are indicated.
- B. Coordinate installation of architectural joint assembly materials and associated work so complete assemblies comply with assembly performance requirements.
- C. Install factory-fabricated transitions between building expansion-joint cover assemblies and roof expansion-joint assemblies to provide continuous, uninterrupted, watertight construction.
- D. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required to install joint systems.
 - 1. Install joint cover assemblies in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.
 - 3. Set covers in horizontal surfaces at elevations that place exposed surfaces flush with adjoining finishes.
 - 4. Locate covers in continuous contact with adjacent surfaces.
 - 5. Securely attach in place with required accessories.
 - 6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- E. Continuity: Maintain continuity of joint systems with a minimum number of end joints and align metal members. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames. Adhere flexible filler materials, if any, to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- F. Extruded Preformed Seals: Install seals to comply with manufacturer's written instructions and with minimum number of end joints.
 - 1. For straight sections, provide preformed seals in continuous lengths.
 - 2. Vulcanize or heat-weld field splice joints in preformed seal material to provide watertight joints using procedures recommended by manufacturer.
 - 3. Apply adhesive, epoxy, or lubricant adhesive approved by manufacturer to both frame interfaces before installing preformed seals.
 - 4. Seal transitions according to manufacturer's written instructions.
 - 5. Install foam seals with adhesive recommended by manufacturer and heat seal all splices.

- G. Joint Systems with Seals: Seal end joints within continuous runs and joints at transitions according to manufacturer's written instructions to provide a watertight installation.
- H. Seismic Seals: Install interior seals in continuous lengths. Seal transitions and end joints according to manufacturer's written instructions.
- I. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and end joints.

3.3 CLEANING AND PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

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.
- 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 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.

C.B. Related Work: The following items are not included in this Section and will be performed 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.
- 5. DIVISION 26 – ELECTRICAL for access control.

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. 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.

- C. 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.
- D. Qualification Data: For Installer.
- E. 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. Mesker Door Inc.
 5. Pioneer Industries, Inc.
 6. Philipp Manufacturing Company.
 7. Republic Builders Products Company.
 8. 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.
- 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.
 - 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. 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.
- C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. 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. 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.
 - 3. Thickness of frames that have a 4'-0" wide and greater door opening: 0.067-inch-thick steel sheet.
- C. 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. Glazed Lites: Factory cut openings in doors.
 - 2. 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 non-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 non-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.
 - 6. Glazing stops shall be factory prepared to fit into the glazed lite opening complete with pre-installed holes in stops and frames for the fasteners.
- 2.11 STEEL FINISHES
- A. Prime Finish: Apply manufacturer's standard 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.

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.
- E. Coordinate with electrical contractor for access to and testing of electrical door hardware and access control.

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.
- 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 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 faces.
 - 2. Factory finishing for transparent wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
 - 4. Louvers for flush wood doors.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 042000 - UNIT MASONRY for building anchors into and grouting steel frames in masonry construction.
 - 2. Section 081100 - HOLLOW METAL DOORS AND FRAMES, for metal frames at wood doors
 - 3. Section 083470 - SOUND CONTROL DOOR ASSEMBLIES for acoustic rated doors.
 - 4. Section 087100 - DOOR HARDWARE for hardware for wood doors.
 - 5. Section 088000 - GLAZING for glass view panels in flush 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. 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 requirements.
 - 5. Indicate fire ratings for fire doors.

- C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
 - 1. Faces of Factory-Finished Doors: Show the full range of colors available for stained finishes.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), 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. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.
 - 3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
 - 4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 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.
- C. 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. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
 - 2. Provide Flush Wood doors with a performance grade of Extra Heavy Duty as outlined by the WDMA I.S.1-A.
 - 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.
 - 1. Test Pressure: After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
 - 2. Oversize, Fire-Rated Wood Doors: For door assemblies exceeding sizes of tested assemblies, provide oversize fire door label or certificate of inspection, from a testing and inspecting agency acceptable to authorities having jurisdiction, stating that doors comply with requirements of design, materials, and construction.
 - 3. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.
 - D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Comply with requirements of referenced standard and manufacturer's written instructions.
 - B. Package doors individually in cardboard cartons and wrap doors in plastic sheeting..
 - C. Mark each door on top and bottom rail with opening number used on Shop Drawings.
- 1.7 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.
- 1.8 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.
 - 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. Marshfield Door Systems.
 - d. Mohawk Flush Doors, Inc.
 - e. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that contain no added urea formaldehyde.
- B. Provide acoustic rated doors with STC rating as indicated on door schedule.
- C. Doors for Transparent Stained Finish:
1. Grade: Premium, with Grade A faces.
 2. **Species and Cut: Select White Maple, Quarter Sliced.**
 3. **Species and Cut: Select White Maple, Plain Sliced.**
 4. Match between Veneer Leaves: Slip match.
 5. Assembly of Veneer Leaves on Door Faces: Running match.
 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 7. Stiles: Same species as faces.
 8. Stain: Match Architects sample.

2.3 SOLID-CORE DOORS

- A. Cores: Comply with the following requirements:
1. Particle Core: ANSI A 208.1, Grade 1-LD-2
 2. Stave Lumber Core: lumber staves, edge glued, kiln-dried softwood lumber of single species, with horizontal joints staggered in contiguous rows.
 3. Agrifiber Core: ANSI A 208.1, Grade 1-LD-2.
 4. Structural Composite Lumber Core: Timberstrand LSL
 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.
 6. Blocking: Provide structural composite blocking in Particleboard and Agrifiber cored doors as needed to increase screw holding to 700 pounds and eliminating the need for through-bolting hardware, as follows:
 - a. 5-inch (125-mm) top rail blocking in doors indicated to have Closers or Overhead Door Controls.
 - b. Additional or wider blocking as recommended by hardware manufacturer.
- B. Interior Veneer-Faced Doors:

1. Construction: Five plies 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.
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: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
 - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.
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 louvers, unless otherwise indicated.
- B. Wood Beads for Light Openings in Wood Doors:
 1. Wood Species: Same species as door faces.
 2. Profile: Flush Bead, squared-off profile. Provide radiused and continuous beads for circular vision panels.
 3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.
- C. 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: Factory prime and premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.
 3. Coordinate with project security requirements, removable mullions, and electronic door functions.
 4. Comply with manufacturers requirements for installing hardware including type and installation of fasteners.
- C. 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 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.
- C. Transparent Finish:
1. Grade: Premium.
 2. Finish: Manufacturer's solvent-based catalyzed polyurethane finish with performance comparable to AWS System 11. Water based polyurethane finish may be provided for doors not requiring staining. Provide two finish coats.
 3. Staining: Provide custom color as selected by Architect.
 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 083100

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.
- 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 intent of this Section is to describe product and installation requirements for all access panels to be installed on this Project.
 - 1. Access panels required by the Work of Mechanical Divisions – 21, 22, 23, and Division 26 – ELECTRICAL shall be furnished by the trade whose work requires access through otherwise solid construction, and installed by the trade responsible for the construction in which they will be installed.
 - 2. All other access panels shown on Drawings or otherwise required shall be furnished under this Section, and installed by the trade responsible for the construction in which they will be installed.
- B. The Work of this Section includes, but is not limited to, the following:
 - 1. Access panels for locations as required by the work of the General Contractor. Access panels include the following types:
 - a. Wall access panels.
 - b. Ceiling access panels.
- C. Products furnished but not installed in this Section include the following:
 - 1. Access panels in masonry construction, including lintels as needed, shall be installed under Section 042000 – UNIT MASONRY.
 - 2. Access panels in gypsum drywall construction shall be installed under Section 092900 – GYPSUM BOARD ASSEMBLIES.
 - 3. Access panels in tile construction shall be installed under Section 093000 – TILING.
- D. Related work includes but is not limited to the following work covered in other sections:
 - 1. Lintels for access panels in masonry construction: Section 055000 – METAL FABRICATIONS.
 - 2. Field painting of access panels to match surrounding finish: Section 099000 – PAINTING AND COATING.

1.3 PERFORMANCE REQUIREMENTS

- A. Fire Ratings: Provide fire-rated access panels with UL labels consistent with fire ratings of adjacent construction, in compliance with NFPA 80.
 - 1. UL Certified fire-rating: 1-1/2 hour, Class B.
 - 2. UL Certified maximum temperature rise: 250° F.

1.4 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 011000 – GENERAL REQUIREMENTS..
 - B. Product Data: For each material and manufactured product specified.
 - C. Shop Drawings: Show fabrication and installation details of access panels in each type of construction.
 - D. Schedule: Submit a schedule of access panel doors and frames including types, general locations, sizes, latching or locking provisions and other installation information.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed type of work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 COORDINATION

- A. Coordinate product selection with Subcontractors responsible for installation of access doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. Larsen's Manufacturing Company
 - 2. Milcor Limited Partnership
 - 3. Nystrom Building Products Co.
 - 4. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by the Milcor Limited Partnership, to establish the general character and materials required for access panels for this project. Equivalent products by acceptable manufacturers will be approved.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A569/A 569M, Commercial Steel (CS), Type B; free of scales, pitting and surface defects, pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A366M, Commercial Steel (CS) or ASTM A 620/A 620M, Drawing steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 (ZF180) zinc-iron alloy (galvannealed) coating or G60 (Z180) mill-phosphated zinc coating, stretcher-leveled standard of flatness.

2.3 ACCESS PANELS FOR WALLS AND CEILINGS

- A. Fire-Rated Access Doors and Frames:
 - 1. Description: Flush, insulated access panels, with self-closing, self-latching door and exposed trim.
 - 2. Locations: Fire-rated masonry, ceramic tile, gypsum wallboard wall and ceiling surfaces.
 - 3. Dimensions: As required for access to equipment.
 - 4. Door: Flush panel door with a 2-inch thick core of mineral fiber insulation enclosed in 20-gauge sheet metal.
 - 5. Frame: 14-gauge steel frame with surface-mounted trim; provide masonry anchors as needed.
 - 6. Hardware:
 - a. Hinge: Continuous type steel hinge with stainless steel pin.
 - b. Closer: Integrated concealed spring system.
 - c. Lock: Self-latching, with flush key-operated cylinder and interior release mechanism. Provide one lock per access panel smaller than 36 inches by 36 inches; provide two locks for larger access panels.
 - 7. Product: Milcor Limited Partnership, *Universal Fire Rated Access Doors for Walls and Ceilings, Style UFR*, or equal.
- B. Non-Rated Access Doors and Frames:
 - 1. Description: Flush access panels with concealed trim in drywall applications.
 - 2. Locations: Masonry, ceramic tile, gypsum wallboard wall and ceiling surfaces.
 - 3. Dimensions: As required for access to equipment.
 - 4. Door: Flush panel door fabricated from 14-gauge sheet metal.
 - 5. Frame: 14-gauge steel frame with concealed trim in drywall applications; provide masonry anchors as needed.
 - 6. Hardware:
 - a. Hinge: Continuous type steel hinge with stainless steel pin.
 - b. Closer: Integrated concealed spring system.
 - c. Lock: Flush key-operated cylinder and interior release mechanism.
 - 7. Product:
 - a. For installation in gypsum wallboard construction: Milcor Limited Partnership, *Style DW*, or equal.
 - b. For installation in plaster construction: Milcor Limited Partnership, *Style K*, or equal.
 - c. For installation in masonry construction: Milcor Limited Partnership, *Style M*, or equal.
- C. Provide stainless steel access doors and frames in high moisture areas and in all tile loca-

tions.

2.4 FABRICATION

- A. General: Access panel doors and frames shall be factory assembled and shipped as integral units ready for installation.

2.5 FINISHES

- A. Primer for typical access doors and frames: Manufacturer's standard primer applied in factory after assembly of door and frame.
 - 1. Primer for typical locations: Baked-on electrostatic powder chemically bonded to the steel.
- B. Stainless Steel: Directional Satin Finish: No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine existing and completed work for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install access frames and doors in strict accordance with manufacturer's instructions.
- B. Set frames to proper alignment with adjacent wall or ceiling construction.
- C. Position access panels for proper access to concealed equipment requiring access.
- D. At completion of installation, secure each access panel in shut position.

3.3 ADJUSTING AND CLEANING

- A. Adjust panel after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed or damaged.
- C. Protection: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure access panels without damage and deterioration at the time of Substantial Completion.

HMFH PROJECT NO. 403114
March 15, 2016

Dover High School & Career Technical Center
Dover, NH

END OF SECTION

SECTION 083300

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. Manually-operated and electric-motor-operated overhead coiling doors of the following types:
 - a. Insulated and non-insulated full height service doors.
 - b. Non-insulated counter doors.
- B. 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 083320 - OVERHEAD COILING GRILLES for coiling grilles.
 - 3. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 4. Section 099000 - PAINTING AND COATING for field-applied paint finish.
 - 5. 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. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. 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. McKEON Door Company.
 - 3. Overhead Door Corp.
 - 4. Raynor Garage Door Co.
 - 5. Wayne-Dalton Corp.

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. Stainless-Steel Door Curtain Slats: ASTM A 666, Type 304; sheet thickness of 22 gauge and as required to meet requirements.
 - a. Profile: Flat.
 - b. Finish: No. 4, Satin Finish.
- 3. Insulation: Fill slat with manufacturer's standard rigid cellular polystyrene or polyurethane-foam-type thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within metal slat faces.
- 4. 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 doorjambs 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 MANUAL DOOR OPERATOR

- A. General: Equip door with manual door operator by door manufacturer.
- B. **Chain-Hoist Operator: Provide manual chain-hoist operator consisting of endless steel hand chain, chain pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf (111-N) force for door operation. Provide alloy steel hand chain with chain holder secured to operator guide.**
- C. **Push-up Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25-lbf (111-N).**

2.6 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.

2.7 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.

2.8 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain of directional finishes with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 3. Directional Satin Finish: No. 4.

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 083310

FIRE SHUTTERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.2 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited to, the following:
 - 1. Overhead coiling fire shutters and related items.
 - 2. Complete operating assemblies including curtains, guides, counterbalance mechanism, hardware, operator, and accessories.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect Work of this Section. Other Specification Sections that relate directly to Work of this Section include, but are not limited to:
 - 1. Section 055000, Metal Fabrications; Metal framing and supports.
 - 2. Section 087100, Finish Hardware; Key cylinders for locks.
 - 3. Section 099000, Painting; Finish painting of overhead coiling door assemblies.
 - 4. Division 26 - Electrical; Wiring for electric motor operators.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data, rough-in diagrams, installation instructions, use limitations and recommendations for each material used. Provide operating instructions and maintenance manuals. Provide certifications stating that materials comply with requirements.
- B. Shop Drawings: Provide large scale shop drawings for fabrication, installation and erection of all parts of the work not fully described by manufacturer's product data. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Provide wiring diagrams for electrically operated doors.
- C. Field Measurements: Take accurate field measurements before preparation of shop drawings and fabrication. Do not delay job progress.
- D. Label Certification: Submit UL certification for oversized fire-rated doors and frames (if any) that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.

1.5 QUALITY ASSURANCE

- A. Source: For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturers of the primary materials.
- B. Provide motorized assemblies bearing the UL seal.
- C. Where fire-rated assemblies are indicated, provide fire door assemblies that comply with NFPA 80 and have been fire tested, rated, and labeled in accordance with ASTM E 152. Provide fire-rated doors with metal UL label indicating rating in hours of duration of exposure to fire, and letter designation of location for which assembly is designed.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.7 PROJECT CONDITIONS

- A. Provide inserts and anchorages which must be built into other work at the time they are needed. Avoid project delays.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products of one of the following, that meet or exceed requirements specified:
 - 1. Alpine Overhead Doors, Inc.
 - 2. Cornell Iron Works
 - 3. Overhead Door Corporation
 - 4. Raynor Door Co.

2.2 INTERIOR ROLLING FIRE SHUTTER

- A. Label: Provide fire doors certified with fire rating as required.
- B. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
 - 1. Flat profile type.
- C. Finish: Steel slats and hood shall be galvanized steel in accordance with ASTM A 525 and receive rust-inhibitive, roll coating process, including bonderizing, 0.2 mils thick baked-on prime paint, and 0.6 mils thick powder coated top coat. Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
 - 1. Color: Powder coating finish in color as selected by Architect from manufacturers

standard colors.

- D. Bottom Bar: Two galvanized structural steel angles 1-1/2 by 1-1/2 by 1/8 minimum.
- E. Guides: Roll-formed steel shapes attached to continuous steel wall angle for doors through 12' wide. Guides for between jamb doors shall be structural angles.
 - 1. Fastening Guides to Non-Masonry Fire Walls: Comply with the manufacturers listing.
- F. Brackets: Steel plate to support counterbalance, curtain and hood.
- G. Counterbalance: Helical torsion spring type. Counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 per foot of span. Counterbalance shall be adjustable by means of an adjusting tension wheel.
- H. Hood: 24 gauge galvanized primed steel minimum for wall openings through 19' wide. Hood shall be equipped with thermally controlled, internal, galvanized steel flame baffle as required.
- I. Locking: Interior slide lock for electric operation with interlock switch.
- J. Wall Mounting Condition: As indicated on the Drawings.
- K. Supports: Provide all support steel and framing required not otherwise supplied under Section 055000.
- L. Automatic Closure: Provide automatic closing on alarm by electric operator with uninterruptible power supply for operator.

2.3 OPERATION

- A. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Provide motor with electrical characteristics compatible with building service and available power, 120V or 277V as available in the building.
 - 1. Sensing Edge Protection: Electric sensing edge at bottom rail.
 - 2. Operator Controls: Push-button and key operated control stations with open, close, and stop buttons for flush mounting.
 - 3. Comply with NFPA 70.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation of work of this Section shall be by the manufacturer or his authorized representative, and in strict accordance with the manufacturer's printed installation instructions and specifications.
 - 1. Install fire-rated doors to comply with NFPA 80.
- B. Install units plumb, level and true, securely anchored, complete in all respects, and in perfect

operating condition.

END OF SECTION

SECTION 083320

OVERHEAD COILING GRILLES

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 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 overhead coiling grilles.
- B. 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 079200 - JOINT SEALANTS for weatherproof joints at hoods.
 - 3. Section 083310 - OVERHEAD COILING DOORS for service and counter doors.
 - 4. Section 087100 - DOOR HARDWARE for lock cylinders and keying.

1.3 PERFORMANCE REQUIREMENTS

- A. Operation-Cycle Requirements: Provide overhead coiling grille 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 grille and accessory.
 - 1. Summary of forces and loads on walls and jambs.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.
- C. 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 grilles through one source from a single manufacturer.
 - 1. Obtain operators and controls from overhead coiling grille manufacturer.

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.
 - 4. Wayne-Dalton Corp.

2.2 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

- A. General: Fabricate overhead coiling grille curtain consisting of a network of 1/4-inch-minimum diameter horizontal rods, or rods covered with tube spacers, spaced as indicated. Interconnect rods by vertical links approximately 5/8 inch wide, spaced as indicated and rotating on rods.
 - 1. Space rods at approximately 1-1/2 inches o.c.
 - 2. Space links approximately 6 inches apart in a straight in-line pattern.
 - 3. Aluminum Grille Curtain: ASTM B 221 alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- B. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.
- C. Bottom Bar: Manufacturer's standard continuous channel, tubular shape, or two angles, finished to match grille.
 - 1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for grille.
 - 2. Provide motor-operated grilles with combination bottom astragal and sensor edge.
- D. Grille Curtain Jamb Guides: Manufacturer's standard extruded-aluminum shape having curtain groove with return lips or bars to retain curtain. 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 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 aluminum grilles of minimum 0.032-inch-thick aluminum, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, complying with ASTM B 209.
 - 2. Provide removable metal soffit of same material and finish as curtain if hood is mounted above ceiling, unless otherwise indicated.
- B. Push/Pull Handles: For push-up-operated or emergency-operated grilles, provide manufacturer's standard lifting handles on each side of grille.
- 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 grille curtain is power operated, provide safety interlock switch to disengage power supply when grille is locked.

2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance grille curtain by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to grille 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 grille curtain without distortion of curtain and to limit barrel deflection to not more than 0.03 in./ft. 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 grille 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 MANUAL GRILLE OPERATORS

- A. Push-up Operation: Design counterbalance mechanism so required lift or pull for grille operation does not exceed 25 lbf .

2.6 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 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 INSTALLATION

- A. General: Install grilles and operating equipment, complete with necessary hardware, according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust grilles to operate easily, free of warp, twist, or distortion and with tight fit around entire perimeter.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION

SECTION 083470
SOUND CONTROL DOOR 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.
- 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 sound-control door and frame assemblies consisting of components and accessories required to achieve STC ratings indicated.
 - 1. Wood acoustical door and frame assemblies.
 - 2. Fire-rated wood acoustical door and frame assemblies.
 - 3. Hollow metal acoustical door and frame assemblies.

G.B. Related Sections include the following:

- 1. Section 081100 – METAL DOORS AND FRAMES, for non-sound-control, hollow-metal doors and frames.
- 2. Section 081400 – WOOD DOORS, for non-sound-control wood doors.
- 3. Section 087100 – DOOR HARDWARE, for hardware to the extent not specified in this Section, including locksets and cylinders.
- 4. Section 088000 – GLAZING, for general requirements for glass and glazing.
- 5. Section 099000 – PAINTING AND COATING, for field painting sound-control door assemblies.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base material without coatings.

1.4 PERFORMANCE REQUIREMENTS

- A. Sound Rating: Provide sound-control door assemblies that have been fabricated and tested as sound-retardant complete assemblies, are identical to assemblies tested according to ASTM E 90 by an independent testing agency, and have the following minimum certified STC rating according to ASTM E 413:
 - 1. STC Rating for Wood Acoustic Door assemblies: STC-49 minimum.

1.5 SUBMITTALS

- A. Product Data: Include sound ratings, construction and hardware preparation details, material and gasketing descriptions, core descriptions, label compliance, fire-resistance rating, dimensions of individual components and profiles, and finishes for sound-control door assemblies.
- B. Shop Drawings: In addition to requirements below, provide a schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
 - 1. Elevations of each door and frame design.
 - 2. Details of sound-control seals, door bottoms, and thresholds.
 - 3. Details of doors including vertical and horizontal edge details.
 - 4. Frame details for each frame type including dimensioned profiles.
 - 5. Details and locations of reinforcement and preparations for hardware.
 - 6. Details of each different wall opening condition.
 - 7. Details of anchorages, accessories, joints, and connections.
 - 8. Details of glazing frames and stops showing glazing.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).
- E. Product Certificates: For each type of sound-control door assembly, signed by product manufacturer.
- F. Qualification Data: For acoustical testing agency. Provide certification that the door construction utilized has been tested at an independent laboratory in accordance with ASTM E90, and that the STC rating determined in accordance with ASTM E413, is not less than that specified in Part 1.4 of this Section. The laboratory referenced in the certification must be qualified under the National Voluntary Accreditation Program (NVLAP) of the U.S. Bureau of Standards. Certification must reference laboratory name, test report number, and date of test; substitution of test data not in accordance with ASTM E90 and E413 will not be acceptable.
- G. Product Test Reports: Based on evaluation of comprehensive sound-rating and fire tests performed by an independent, third party, qualified testing agency, for each type of sound-control door assembly.
- H. Maintenance Data: For sound-control door assemblies to include in maintenance manuals.
- I. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for either training the GC's installers or direct installation of units required for this Project.

- B. Source Limitations: Obtain sound-control door assemblies, including doors, frames, sound-control seals, door bottom seals & hinges (when integral for sound control), and other items essential for sound control, through one source from a single manufacturer.
- C. Safety Glass: Category I or II materials complying with testing requirements in 16 CFR 1201.
- D. Fire-Rated, Sound-Control Door and 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. Test Pressure: Test at positive pressure according to NFPA 252 or UL 10C.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013119 – Project Meetings. Review methods and procedures related to sound-control door assemblies including, but not limited to, the following:
 - 1. Review required field quality-control procedures.
 - 2. Installation methods and control procedures.

1.7 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 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.

1.8 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 non-vented plastic.
 - 1. Provide additional protection to prevent damage to finish of factory-finished wood doors.
- B. Deliver frames with removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (100-mm-) high, wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install sound-control wood doors until spaces are enclosed and weatherproof, 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.

1.10 COORDINATION

- A. Coordinate installation of anchorages for sound-control door assemblies. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sound-control door assemblies that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet sound rating requirements.
 - b. Faulty operation of sound seals.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal use or weathering.
 - d. Wood doors that are warped (bow, cup, or twist) more than 1/4 inch (6 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
 - 2. Warranty Period for Wood Doors: Two 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. Sound-Control Door Assemblies with Wood Doors:
 - a. Overly Door Company
 - b. Industrial Acoustics Co.
 - c. Wenger Corp.
 - d. Krieger.
- B. Basis of Design: Sound Retardant Wood Swinging Door System designs are based on those manufactured by Overly Door Company, Greensburg, PA 15601. Tel 800-979-7300, Fax 724-830-2871.
- C. Performance:
 - 1. Sound Retardant Wood Swinging Door System to be Overly Model No. STC-499723 or equal with STC rating of 49 when tested as a flush, operable system in accordance with ASTM E90 and ASTM E413.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- B. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- D. Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching sound-control door frames of type indicated.
- E. Grout: Comply with ASTM C 476, with a slump of 4 inches (102 mm) for sound-control door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.
- F. 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. (96 to 192 kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- G. Glazing: As required by sound-control door assembly manufacturer to comply with sound-control and fire-rated-door labeling requirements.

2.3 WOOD DOORS

- A. Provide flush-design wood doors, not more than 1-3/4 inches (44 mm) thick; with manufacturer's standard sound-retardant core as required to provide STC and fire rating indicated. Fabricate wood doors with tolerances according to WDMA 1.S.1-A. 1-3/4" metal doors with applied veneers are not acceptable.
- B. Comply with Section 081400 – Flush Wood Doors, for grade, faces, veneer matching, fabrication, finishing, and other requirements, unless otherwise indicated.
 - 1. Stiles: Same species as faces.

2.4 STEEL FRAMES

- A. General: Fabricate sound-control door frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. Knocked-down frames are not acceptable.
 - 1. Interior Frames: Formed from minimum 0.067-inch- (1.7-mm-) thick, cold-rolled steel sheet, unless otherwise indicated.
- B. Hardware Reinforcement: Fabricate reinforcement plates from same material as door frame to comply with the following minimum sizes:
 - 1. Hinges: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (150 mm) longer than hinge, secured by not less than 6 spot welds.
 - 2. Strikes, Flush Bolts, and Closers: Minimum 0.093 inch (2.3 mm) thick.
 - 3. Surface-Mounted Hardware: Minimum 0.093 inch (2.3 mm) thick.
- C. Head Reinforcement: Minimum 0.093-inch- (2.3-mm-) thick, steel channel or angle stiffener.
- D. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed of same material as frame, not less than 0.053 inch (1.3 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.156 inch (4.0 mm) wide.
 - 2. Stud Wall Type: Designed to engage metal stud, welded to back of frames; formed of same material as frame, not less than 0.042 inch (1.0 mm) thick.
 - 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide spacer from frame to wall with throat reinforcement plate, welded to frame at each anchor location.
- E. Floor Anchors: Formed of same material as door frame, not less than 0.067 inch (1.7 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 (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

- F. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.
- G. Plaster Guards: Same material as frame, not less than 0.026 inch (0.6 mm) thick.
- H. Miscellaneous Components: Fabricated from hot- or cold-rolled steel sheet.

2.5 STOPS AND MOLDINGS

- A. Fixed Frame Moldings: Formed integral with sound-control frames, unless otherwise indicated.
- B. Stops for Glazed Lites: Minimum 0.032 inch (0.8 mm) thick, formed of same material as door.

2.6 DOOR HARDWARE

- A. General: Provide manufacturer's standard sound-control system, including head and jamb seals, door bottom sealing systems- Type A- Standard Heavy-Duty hinges with concealed automatic door bottom, or type B- Cam-lift hinges with semi-mortised, mechanically adjustable seal as required by testing to achieve STC rating indicated.
 - 1. Refer to Section 087100 – Door Hardware, for schedule of hardware for sound-control door assemblies not specified in this Section.
- B. Hinges:
 - 1. Type A- Standard templated, extra heavy-weight 5" x 4-1/2" hinges.
 - 2. Type B- If required for acoustic performance manufacturer's standard cast stainless-steel cam-lift hinges with bronze bushings. Manufacturer to furnish laboratory test data certifying hinges have been cycled a minimum of 1,000,000 while supporting a minimum door weight of 350 pounds.
- C. Compression Seals (as required for acoustic performance): One-piece units; consisting of closed-cell sponge neoprene and felt, held in place by metal retainer; with retainer cover of same material as door frame. Or two-piece double bubble, adhesive backed, neoprene or silicone gasketing to be field applied before finish painting of door frames.
- D. Door bottom seals:
 - 1. Type A- Semi-mortised, one piece units; consisting of closed-cell sponge neoprene affixed to a metal, mechanically adjustable mounting plate.
 - 2. Type B- Automatic Concealed Door Bottoms: Neoprene or silicone gasket held in place by metal housing; mortised into bottom edge of door with slotted activation rod for acoustic adjustment.
- E. Raised thresholds are not acceptable. System shall be designed to achieve desired STC performance utilizing the openings standard, flush, level sealing surface as detailed.

2.7 FABRICATION

- A. General: Fabricate sound-control door assemblies to be rigid and free of defects, warp, or buckle. 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.

1. Glazed Lites: Factory cut openings in sound-control doors.
- B. Wood Doors: Factory fit doors to suit frame-opening sizes indicated, with uniform clearances and bevels according to referenced quality standard, unless otherwise indicated. Comply with final door hardware schedules and hardware templates.
1. Comply with clearance requirements in NFPA 80 for fire-rated doors.
- C. Steel Frames: Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Weld exposed joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
 2. Plaster Guards: Provide guards to frame at back of hardware cutouts and glazing-stop screw and sound-control seal preparations to close off interior of openings and prevent mortar or other materials from obstructing hardware operation or installation.
 3. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 5. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches (1524 mm) in height.
 - 2) Three anchors per jamb from 60 up to 90 inches (1524 up to 2286 mm) in height.
 - 3) Four anchors per jamb from 90 up to 96 inches (2286 up to 2438 mm) in height.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
 - b. Stud Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches (1524 mm) in height.
 - 2) Four anchors per jamb from 60 up to 90 inches (1524 up to 2286 mm) in height.
 - 3) Five anchors per jamb from 90 up to 96 inches (2286 up to 2438 mm) in height.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
 - 5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal stud partitions.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
 6. Head Reinforcement: For frames more than 48 inches (1219 mm) wide, provide continuous head reinforcement for full width of opening, welded to back of frame at head.
- D. Hardware Preparation:

1. Wood Doors: Locate door hardware as indicated, or if not indicated, according to DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - a. Coordinate measurements of hardware mortises in steel frames to verify dimensions and alignment before factory machining.
- E. Glazing: Factory install glazed lites according to requirements of tested assembly to achieve STC rating indicated.
- F. 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 on secure side of door.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
 3. Coordinate rabbet width between fixed and removable stops with type of glass and type of installation indicated.

2.8 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Finish sound-control steel door assemblies after assembly.
- B. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- C. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).
 1. Shop Primer: Manufacturer's standard, water-based, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

2.9 WOOD FINISHES

- A. Finish sound-control wood doors after assembly.
- B. Factory finish sound-control wood doors to match doors specified in Section 08210 – Flush Wood Doors."

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 sound-control door assemblies.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of sound-control door frame connections before frame installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace sound-control door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install sound-control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Frames: Install sound-control door frames in sizes and profiles indicated.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, make splice smooth, flush, and invisible on exposed faces.
 - c. Install sound-control frames with removable glazing stops located on secure side of

- opening.
 - d. Remove temporary braces only after frames or bucks have been properly set and secured.
 - e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing anti-freezing agents.
 - g. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with post-installed expansion anchors.
 - 1) Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors, if so indicated and approved on Shop Drawings.
 - h. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 - i. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
 - j. In-place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
2. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, 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 above. Provide adjustable wedged or bolted anchorage to frame jamb members.
3. Installation Tolerances: Adjust sound-control door frames for squareness, alignment, twist, and plumb to the following tolerances:
- a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.
- C. Doors: Fit sound-control doors accurately in frames, within clearances indicated below. Shim as necessary.
1. Non-Fire-Rated Doors: Fit non-fire-rated doors accurately in frames with the following clearances:
- a. Jambs: 1/8 inch (3 mm).
 - b. Head with Butt Hinges: 1/8 inch (3 mm).
 - c. Head with Cam-Lift Hinges: As required by manufacturer, but not more than 3/8 inch (9.5 mm).
 - d. Sill: Manufacturer's standard.
 - e. Between Edges of Pairs of Doors: 1/8 inch (3 mm).
2. Fire-Rated Doors: Install fire-rated doors with clearances according to NFPA 80.
- D. Sound-Control Seals and Door Bottoms: Install seals and adjust according to manufacturer's written instructions. For type A, match retainers, covers and seals to their mark numbers.

E. Hinges: Install hinges according to manufacturer's written instructions.

G.F. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and sound-control door assembly manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

H.G. Hardware and Security Coordination:

1. Prior to installation of hardware, schedule and hold a meeting for the purpose of instructing installers on proper application, installation and adjustment of finish hardware on acoustic assemblies.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and adjust operating hardware items just before final inspection. Leave work in complete and proper operating condition.

B. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise unacceptable.

1. Adjust gaskets, gasket retainers, and retainer covers to provide contact required to achieve STC rating.

C. Clean grout off sound-control door frames immediately after installation.

D. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

E. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 083513

FOLDING 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.
- 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 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 and glass interior folding doors, manually operated.
- B. Related Work: The following items are not included in this Section and are specified under the designated Sections:
 - 1. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 2. Section 061000 - ROUGH CARPENTRY for blocking and supports.

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 folding doors.
- B. Shop Drawings: For folding doors. Include plans, elevations, sections, details, attachments to other work, clearances required for operation, and accessory items. Show blocking.
- C. Setting Drawings: For anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete and masonry, and for cutouts required in other work, including support-beam punching template.
- D. Samples for Verification: For each type of folding door indicated and for each type of exposed finish required, in manufacturer's standard sizes.
- E. Qualification Data: For qualified 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.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication

PART 2 - PRODUCTS

2.1 PANEL FOLDING DOORS

- 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. Nana Wall Systems, Inc.; www.nanawall.com.
 - 2. Solar Innovations, Inc.
 - 3. Kwik-Wall Company.
- B. General: Top-supported, horizontal-sliding, manually operated panel folding doors, with panels joined by continuous hinge connectors for the full height of panels.
- C. Frames and Panels: Aluminum extrusions with nominal thickness of 0.098 in. min. Alloy specified as AlMgSi 0.5 with strength rated as 6063-T5. Provide profiles as shown on Drawings.
- D. Glass: Clear insulating glass with low-E coating on the No. 2 surface; tempered where required by code; 1 in. nominal thickness; comply with requirements of Section 088000 - GLAZING.
- E. Carriers: Four-wheel carriers at lead post and two-wheel carriers at intermediate spacing, as necessary for size and weight of partition, to ensure secure, easy, and quiet operation.
 - 1. Panels 5 Inches Wide or Less: Nylon wheels and axles.
 - 2. Panels More Than 5 Inches Wide: Ball-bearing wheels with nylon tread and steel shafts.
- F. Tracks: Manufacturer's standard extruded-aluminum or steel track with factory-applied, corrosion-resistant finish. Limit track deflection, independent of structural supporting system, to no more than 80 percent of bottom clearance. Design and fabricate track to support operation without damage to track, folding unit, or adjacent surfaces; complying with the following requirements:
 - 1. Prefinished ceiling guard/channel for recessed tracks.
 - 2. Galvanized-steel sheet or aluminum subchannel for forming pocket for recessed suspension track.
 - 3. Nonferrous jamb strip for single-operating partitions to ensure tight closure by engaging rubber bumper on lead post.

- G. Hinge Connector: Manufacturer's standard extruded-vinyl hinge connector.
 - 1. Color: As selected by Architect from manufacturer's full range.
- H. Hardware: Manufacturer's standard heavy-duty, manually operated metal pulls and latches as follows:
 - 1. Finish: Satin stainless steel.
 - 2. Latch: Three point locking hardware, operable from both or one side(s) of closed door, as indicated on Hardware Schedule.
 - 3. Lock: Refer to Section 087100 - DOOR HARDWARE for cylinder requirements.
 - 4. Foot bolts on lead post where indicated. Secure to post to avoid interference with seals.
 - 5. Weatherstripping: Manufacturer's standard.
- I. Jamb Molding: Manufacturer's standard metal molding at closing jamb as required for light-tight jamb closure.
 - 1. Metal: Manufacturer's standard finish.
- J. Meeting Post: Fixed single jamb for single-stacked doors.
- K. Stacking: Tiebacks to maintain door in stacked position.
- L. Steel Supports and Framing: Provide miscellaneous steel supports and framing as recommended by manufacturer and as required for a complete installation.

2.2 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. Metallic Color and Gloss: Two colors, as selected by Architect from manufacturer's full range.

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 folding doors.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. For folding doors supported by or anchored to permanent construction, advise installers of specific requirements for placement of anchorage devices. Furnish installers of other work with templates and drawings showing locations of anchorage devices and similar items.

3.3 INSTALLATION

- A. General: Install folding doors complying with manufacturer's written installation instructions. Install track in one piece.
- B. Standard Floor Clearances: 1/4 to 3/4 inch maximum (above floor finish).

3.4 ADJUSTING

- A. Adjust units as necessary to ensure smooth, quiet operation without warping or binding. Adjust hardware to function smoothly. Confirm that latches engage accurately and securely without forcing or binding.

END OF SECTION

SECTION 083610

SECTIONAL 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.
- 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 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. Electrically-motor-operated sectional overhead doors for exterior applications.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
 - 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 3. Division 26 - ELECTRICAL WORK for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure (velocity pressure) as required by Code but not less than 20 lbf/sq. ft. acting inward and outward.
- B. Operation-Cycle Requirements: Provide sectional overhead door components and operators capable of operating for not less than 10,000 cycles.

1.4 SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs.

2. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

C. 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 sectional overhead doors through one source from a single manufacturer.

1. Obtain operators and controls from sectional overhead door manufacturer.

C. 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. Overhead Door Corp.
2. Raynor.
3. Wayne-Dalton.

B. Basis of Design: Provide 592 Series Thermacore Insulated Steel Door as manufactured by Overhead Door Corp., or approved equal.

2.2 EXTERIOR STEEL DOOR SECTIONS

A. Construct door sections including face sheets and frames from zinc-coated (galvanized), cold-rolled, commercial steel (CS) sheet, complying with ASTM A 653/A 653M, G60 coating designation.

1. Minimum Base-Metal (Uncoated) Thickness for Section Faces: 0.053 inch.
2. Exterior-Section Face: Flat.

B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 2 inches deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight seal, with a reinforcing flange return.

1. Provide door sections with continuous thermal-break construction, separating faces of door.

- C. Enclose open sections with channel end stiles formed from not less than 0.064-inch-thick galvanized steel sheet and weld end stiles to door section in place. Provide intermediate stiles formed from not less than 0.064-inch-thick galvanized steel sheet, cut to door section profile, and welded in place.
 - 1. Stile Spacing: Not more than 48 inches apart.
- D. Reinforce bottom section with a continuous channel or angle complying with bottom-section profile.
- E. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses, or strip steel, formed to depth and bolted or welded in place.
- F. Provide reinforcement for hardware attachment.
- G. Thermal Insulation: Insulate inner core of steel sections with door manufacturer's standard polyurethane insulation, foamed in place to completely fill inner core of section and pressure bonded to face sheets to prevent delamination under wind load, and with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely within steel sections that incorporate the following inside facing material, with no exposed insulation material evident:
 - 1. Inside Facing Material: Zinc-coated (galvanized) steel sheet with a minimum base (uncoated) metal thickness of 0.028 inch.
- H. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints and free of warp, twist, and deformation.
- I. Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants.
 - a. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.
 - 2. Apply manufacturer's standard primer and powder-coat finish to interior- and exterior-door faces after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.
 - a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653/A 653M for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track spaced at 2 inches apart for door-drop safety device. Slope tracks at proper angle from vertical or design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.
- B. Track Reinforcement and Supports: Galvanized steel track reinforcement and support members, complying with ASTM A 36/A 36M and ASTM A 123/A 123M. Secure, reinforce,

and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

1. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.
 - a. Repair galvanized coating on tracks according to ASTM A 780.
- C. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of overhead door.
 1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
 2. Provide continuous flexible seals at door jambs for a weathertight installation.
- D. Full-Vision Panels: Manufacturer's standard, tubular, aluminum-framed section fully glazed with insulated double strength glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

2.4 HARDWARE

- A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty galvanized steel hinges of not less than 0.0747-inch-thick, uncoated steel at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch-diameter roller tires for 3-inch-wide track and 2-inch-diameter roller tires for 2-inch-wide track.
- D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.
- E. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
- F. 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.
- G. If door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

2.5 COUNTERBALANCE MECHANISM

- A. Extension Spring: Counterbalance mechanism with aircraft-type steel cable over ball-bearing sheaves. Provide oil-tempered wired springs with internal safety rods. Combine

operation with a spring bumper in each horizontal track to cushion door at end of opening operation.

- B. Torsion Spring: Counterbalance mechanism consisting of adjustable-tension torsion springs fabricated from oil-tempered-steel wire complying with ASTM A 229/A 229M, Class II, mounted on a cross-header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables with cable safety factor of at least 5 to 1. Provide springs calibrated for a minimum of 10,000 cycles.
- C. Cable Drums: Cast-aluminum or gray-iron casting cable drums grooved to receive cable. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts more than 16 feet long unless closer spacing is recommended by door manufacturer.
- D. Cable Safety Device: Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if either cable breaks.
- E. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level shaft and prevent sag.
- F. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.6 ELECTRIC DOOR OPERATORS

- A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycle requirements specified, with electric 1/2 hp motor and factory-rewired 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. Voltage: 120v, 1 phase typical, unless noted otherwise.
- C. Comply with NFPA 70.
- D. Disconnect Device: Hand-operated disconnect device 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 device and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- E. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.
- F. 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.
- G. Electric Motors: 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: Comply with NEMA MG 1, unless otherwise indicated.

- 3. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
- H. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."
- I. 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.
- J. 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.
- K. Limit Switches: Adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. Fasten vertical track assembly to framing, spaced not less than 24 inches apart. Hang horizontal track from structural overhead framing with angle or channel hangers fastened to framing by welding or bolting or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- C. Protect doors and tracks against damage from construction operations and placement of equipment and fixtures during the remainder of construction period.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and with weathertight fit around entire perimeter.
- B. Adjust belt-driven motors as follows:
 - 1. Use adjustable motor-mounting bases for belt-driven motors.
 - 2. Align pulleys and install belts.
 - 3. Tension belt according to manufacturer's written instructions.
- C. Touch-up Painting: Immediately after welding galvanized track to track supports, clean field welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A 780.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain sectional overhead doors.

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Dover, NH

END OF SECTION

SECTION 083620

BI-FOLD 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. Vertical motorized folding bi-fold door, factory glazed.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 055000 - METAL FABRICATIONS for miscellaneous steel supports.
 - 2. Section 087100 - DOOR HARDWARE for lock cylinders and keying.
 - 3. Division 26 - ELECTRICAL WORK for electrical service and connections for powered operators and accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide bi-fold doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Loads: Determine loads based on the following minimum design wind pressures:
 - a. Uniform pressure (velocity pressure) as required by Code but not less than 20 lbf/sq. ft. acting inward and outward.
- B. Operation-Cycle Requirements: Provide bi-fold door components and operators capable of operating for not less than 10,000 cycles.

1.4 SUBMITTALS

- A. Product Data: For each type and size of sectional overhead door and accessory. Include the following:
 - 1. Summary of forces and loads on walls and jambs.
 - 2. Motors: Show nameplate data and ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's product data.

- C. 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 bi-fold doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from sectional overhead door manufacturer.
- C. 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. Hangar Doors of Missouri
 - 2. Hufcor
 - 3. Wilson Doors, Inc.
 - 4. Approved equal

2.2 MATERIALS

- A. Basis of Design: Product to be aluminum B-F2, bi-fold door as furnished by Hufcor.
 - 1. Frames shall be of 6061-T6 architectural aluminum alloy tubing and provide light weight, strength and corrosion resistance.
 - 2. Doors are furnished with full-perimeter seals - a soft rubber top seal, neoprene side seals and a bottom seal that hugs the contour of the ground.
- B. Lift cables to be galvanized steel aircraft cables sized and numerous enough to provide a 5:1 safety factor. Lift cables are to be fastened to the bottom of the door. At the opposite end the cables are to be fastened to a drive shaft cable drum at the top of door by means of a welded ring on the drum. Cables shall not pass through pulleys, thereby reducing maintenance and extending cable lift.
- C. Power Operator - All electrical controls meet National Electrical Code Section 513. Standard voltage is 230V single phase. The 1-1/2 horse power gear motor is equipped with an electric brake and will hold the door in any position during its travel. The drive mechanism and operator is top-mounted. Motor is pre-wired and factory tested and provided with supply cables for final hookup (by electrical contractor).
- D. AC-DRIVE - Shall be Ascent AC-Drive housed in a NEMA 12-rated electrical enclosure. Face mounted Up/Down/stop button allows the operator to operate the door with a push of the button. The enclosure's quick-disconnect enables a technician to quickly turn the power on and off.

2.3 GLAZING SYSTEMS

- A. Glazing: Provide insulating glass units in accordance with Section 088000 – GLASS AND 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 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: Custom color as selected by Architect.

2.5 OPERATION

- A. Door shall be electrically extended/retracted in the opening.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.
- B. The installation of the door system shall be by an authorized factory-trained installer.
- C. Cleaning:
 - 1. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.
 - 2. Cartoning and other installation debris shall be removed to on-site waste collection area.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and with weathertight fit around entire perimeter.
- B. Adjust belt-driven motors as follows:
 - 1. Use adjustable motor-mounting bases for belt-driven motors.

2. Align pulleys and install belts.
3. Tension belt according to manufacturer's written instructions.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train the Owner's maintenance personnel to adjust, operate, and maintain sectional overhead doors.

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.
- 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 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 curtain wall framing, and field glazing of insulated glass units, insulated spandrel units and integral operable vent units.
 - 2. Provide concealed structural components within the curtainwall framing and tie-backs as required to meet structural loads and connection points for sun control devices.
 - 3. Aluminum entrance doors in curtain wall frames.
 - 4. Aluminum canopies connected to curtain wall frames.
 - 5. Aluminum sunscreens connected to curtain wall frames.

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

- 1. Section 072100 –THERMAL INSULATION for spray foam joint insulation.
- 2. Section 072500 – AIR BARRIERS for air barrier system requirements.
- 3. Section 078400 - FIRESTOPPING for perimeter fire-containment systems (safing insulation) field installed with glazed aluminum curtainwall systems.
- 4. 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.
- 5. Section 079500 – EXPANSION CONTROL for expansion joint assemblies.
- 6. Section 087100 – DOOR HARDWARE for hardware for all aluminum entrance doors.
- 7. Section 260000 – ELECTRICAL, for installation of magnetic door contacts for intrusion alarm, and other wiring to be installed within curtain wall framing.

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 (including additional loads on curtainwall system imposed by sun control elements).
 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 10 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 66 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. Test unit to be 7'- 6" x 7'- 6" (80"x 80") Test unit shall include a vertical and horizontal intermediate mullion. Submit proof of compliance with submittals as specified. Submit weighted computer simulation of curtainwall unit size to match CW #XX.
1. SHGC: 0.30 maximum for South & West Units; 0.40 maximum for North & East Units
- K. Thermal Transmittance: Provide curtain wall units that have a whole-unit assembly 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 7'- 6" x 7'- 6" (80"x 80") Test unit shall include a vertical and horizontal intermediate mullion. Submit proof of compliance with submittals as specified. Submit weighted computer simulation of curtainwall unit size to match CW #XX.
1. U-Value: 0.35 maximum
- L. Acoustic Performance: Provide curtain wall framing assembly with sound transmission coefficient (STC) 40 for Band and Choral Classrooms, and STC 45 for Library.
- 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. Product Data of Joint Sealants: Provide product data for all sealants used and proof that sealants are compatible with adjacent construction.

- 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.
 - 3. Shop drawings shall be at 6"=1'-0" scale
 - 4. Show air barrier tie-in configuration and location of all sealants. Include axonometric representation of installation sequence showing all materials required and method of installation- certified by the manufacturer of the air barrier tie-in system.
- 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.
 - 6. Custom Snap Cover profile
 - 7. Custom Sill Profile
 - 8. Assembled custom corner curtainwall unit including custom snap cover and custom sill profile.
- 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 and engineer.
- 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 structural 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. 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.
- G. 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 and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review required testing, inspecting, and certifying procedures.
 - 4. Review requirements for connection to air barrier.

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.
- B. Sequencing: Coordinate the curtainwall fabrication and installation with general contractor and the air barrier subcontractor sequence to ensure that the air barrier tie-in shown on the drawings is achieved. Work with General Contractor to represent proper sequencing on Construction Schedule.

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. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
- 1. Aluminum Curtain Wall with Operable Vents:
 - a. Architectural Window Manufacturing Corporation, 1800i with 3750i Zero Sight Line Project Out Vents.
 - b. Wausau HP-Wall with 3250-Z Zero Sight Line Insert Project Out Vents.
 - c. Vistawall- Reliance TC-HP with 30E Series Project-Out Vent
 - 2. Aluminum Curtain Wall:
 - a. Architectural Window Manufacturing Corporation, 1800i series.
 - b. Wausau HP-Wall
 - c. Vistawall- Reliance TC-HP
 - 3. Stile and Rail Aluminum Entrance Doors to be Special-Lite Entrance Doors or equal as provided by:
 - a. Architectural Window Manufacturing Corporation
 - b. EFCO.
 - c. Wausau.
 - d. Kawneer Company.
 - e. Vistawall.
 - 4. Flush Aluminum Entrance Doors: Commercial Door Systems or equal as provided by:
 - a. Architectural Window Manufacturing Corporation
 - b. EFCO.
 - c. Wausau.
 - d. Kawneer Company.
 - e. Vistawall.
- B. Basis of Design: Products below are designated in terms of names of the following products, to establish the general character and materials required. Equivalent products by acceptable manufacturers will be approved.
- 1. Aluminum Curtain Wall: Architectural Window Manufacturing Corporation, 1800i with 3750i Zero Sight Line Project Out Vents.
 - 2. Stile and Rail Aluminum Entrance Doors: Special-Lite, SL-14.
 - 3. Flush Aluminum Entrance Doors: Commercial Door Systems - A500 Heavy-Duty En-

translucent Doors with custom vision lites.

2.2 MATERIALS

- A. Metal shall be new material, free from warps, buckles, creases, holes, and other defects that impair strength, curability, or appearance and of best commercial quality for the purpose specified. All items shall be true to details, clean, straight, with sharply defined profiles and smooth finish surface.
- B. All supplementary parts necessary to complete each item shall be included, even though such parts are not specifically detailed or specified. All anchors and clips for securing frames to adjacent construction shall be included.
- C. All metals shall have structural properties to safely withstand wind loads reasonably anticipated as required by applicable codes and as specified herein.
- D. All exposed fastening shall be of the same material, color and finish as the metal to which applied, unless otherwise indicated.

2.3 FRAME MATERIALS

- A. Sections: Shall be extruded from 6063-T5 or other approved aluminum alloy.
 - 1. Aluminum Curtain Wall Framing: Major portions of frames shall have not less than 0.094-inch wall thickness. Framing extrusions shall not be less than 0.094-inch thick. Where moldings occur, they shall be not less than .050-inch thick. Continuous extruded screw reinforcing pads of 0.125-inch minimum thickness for clip angles shall be provided in framing sections with wall thickness of less than 0.110-inch.
 - 2. Frame Depth: Provide sizes as indicated on drawings, unless structural calculations indicate need for deeper sections. Contractor shall include all costs for adequate frame sizes as part of Work of this Section.
 - 3. Brake metal, column covers and the like shall be 0.062-inch or heavier.
- B. Bituminous Paint: "Bitumastic 50" by Koppers Company, Inc., "Jennite J-16" by Maintenance Coating Company, or equal as approved.
- C. Fasteners: Stainless steel type 300 series, selected to prevent galvanic action with the components fastened. Where exposed in finished surfaces, color shall match adjacent surfaces. Where exposed fasteners are unavoidable, use oval-head countersunk Phillips head screws. Head diameter of screws shall be one screw size smaller than the shank diameter. Other fastenings used to join and erect component parts shall be of suitable material recommended by components manufacturers and as required to prevent corrosive and galvanic action. Comply with Section 7, "Schedule of Fastener Materials" in NAAMM Curtain Wall Manual.
- D. Inserts: Galvanized steel or cast iron of suitable design and adequate strength for condition of use.
- E. Gaskets: Provide neoprene glazing gaskets per commercial standard CS-230; gaskets shall be continuous on both sides of glass. Vinyl gaskets will not be accepted.
- F. Steel: Angles, plates, bars, rods, tubes, channels and other steel members required to join

or reinforce assembly of aluminum components and to attach curtain wall to building structure shall conform to ASTM A36 and ASTM A283, galvanized and shop painted with zinc-chromate primer after cutting to size.

- G. Aluminum: Angles, plates, bars, and other aluminum members required to join or reinforce assembly of aluminum components shall be of alloys recommended by manufacturer or fabricator to develop required strength of assembly.
- H. Thermal Barrier: Fabricate curtainwall components with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance thermal barrier; located between exterior and interior framing materials; in a manner that eliminates direct metal to metal contact.
 - 1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions. No thermal short circuits shall occur between the exterior and interior.
 - 2. The thermal barrier shall be INSULBAR or equal, and shall consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
 - 3. Poured and debridged urethane thermal barriers shall not be permitted.
- I. Anchorage items, clips, bolts, nuts, and screws: Stainless steel, aluminum, or other metal which is compatible with aluminum, of types and sizes as recommended by the manufacturer for the specific conditions.
- J. Sealant for metal to metal contact surfaces: One part silicone in color to match aluminum finish where exposed and conforming to all applicable requirements of Section 079200 – JOINT SEALANTS.
- K. Sealant for air barrier contact surfaces: Provide sealant and backer rod compatible with air barrier membrane conforming to all applicable requirements of Section 072500 – AIR BARRIER.
- L. Aluminum Formed Sills: Shall be .040-inch minimum thickness aluminum sheet finished to match curtain wall components. Provide custom formed sill profile shown on the Drawings. Color and finish to match aluminum curtain wall frame.
- M. Snap Covers: Provide custom extruded aluminum snap covers and pressure plates in profiles shown on the Drawings. Color and finish to match aluminum curtain wall frame.
- N. Insulation: Provide compressible mineral wool insulation for curtain walls at locations indicated on drawings. Refer to Section 072100-THERMAL INSULATION for requirements.
- O. Trim: Provide aluminum trim as indicated to match windows.

2.4 ALUMINUM SWINGING DOORS

- A. Entrance Door Types:
 - 1. Medium Stile: 1-3/4"-inch thick medium stile type, equal to Special-Lite SL-14 monumental heavy duty series, with 10-inch bottom rail, and 6-1/2" mid rail.

2. Flush: Flush-faced type with custom vision lites.
 - B. Construction: Alloys shall be as previously specified. Frame members shall be of a cross-section to adequately perform under anticipated operating forces and specified wind load. Corner joints shall be self-aligning, reinforced, rigid and watertight. Provide mechanism in top rail for minor clearance adjustment. Exposed door members shall be finished in color as selected by Architect. All other components, fasteners and accessories shall be stainless steel. Stiles, rails and other major components shall be one piece extrusions with 0.125-inch minimum wall thickness. Cutouts for hardware shall be reinforced and cleanly cut.
 - C. Core: Exterior doors shall have water-resistant, non combustible insulating core providing maximum U-factor of 0.14.
 - D. Fabrication: Factory fabricate doors and frames with true mortise and tenon joints. Provide 3/8-inch diameter steel tie rods tops and bottom, through-bolted and secured with locking hex nuts. Doors shall fit frames accurately. Door corners shall be able to withstand a minimum of 2000 pound tension without noticeable deformation. Glass stops for doors shall be part of rail and stile extrusions on exterior; interior stops shall be screw applied and countersunk. Provide glass adaptor for 1" insulating glass units.
 - E. Glazing: Aluminum doors shall be field glazed in accordance with Section 088000 - GLASS AND GLAZING. Provide neoprene glazing channel gasket per commercial standard CS 230; channel shall be continuous, with factory-welded corners. Glass shall be of type and thickness indicated in Section 088000 - GLASS AND GLAZING and on Drawings.
 1. Doors shall have rectangular section glazing stops to accommodate 1" insulating glass units.
 - F. Insulated Panels: Where required, provide insulated panel inserts
 1. Thickness: 1" thick panel.
 2. Core: Foam polyurethane, minimum 5 lbs per cubic foot density.
 3. Face Sheets: 0.062-inch thick aluminum on exposed faces mounted on 1/8"th rigid hardboard.
 - G. Hardware: Machine all doors for hardware according to templates furnished under Section 087100 - FINISH HARDWARE. All operating hardware for aluminum doors, including but not limited to hinges, panic devices, locksets, cylinders, weatherstripping, closures, hold-opens, thresholds and floor or wall stops will be provided under Section 087100 - FINISH HARDWARE. Where required install finish door hardware in shop. Coordinate work with Hardware Supplier and Contractor. Hardware finish except pulls and panic bars shall match finish of doors and frames, except as otherwise approved.
- 2.5 ALUMINUM FINISH
- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Finish system for all aluminum components shall be factory applied after proper preparation. Thoroughly clean all surfaces; remove all blemishes, dents, abrasions, scratches, and tool marks from surfaces which will be exposed to view.

- C. Exterior Finish of all exposed aluminum furnished under this Section, shall be "Kynar 500", "Duranar XL", "Fluoropon", or equal as approved. Provide a 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. Custom colors shall be selected by Architect. Custom colors chosen will be "non-exotic" but will include mica-metallic finish options. Minimum dry film thickness: 1.5 mils. Interior Finish: PPG Duracron in accordance with AAMA 2603 averaging 0.8 mil dryfilm thickness; Pencil hardness, in accordance with ASTM D3363, to be H minimum.
- D. Interior Finish:
1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 2. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.
 3. Color: Provide custom color as selected by Architect.
- E. Doors and door adaptor subframes shall be painted to match.
- F. For Painted Finish: At concealed surfaces use AA-C40 with factory wash primer and shop coat of zinc-chromate primer, or other preparation approved by finish manufacturer.

2.6 FABRICATION

- A. Complete welding, cutting, drilling and fitting of joints prior to chemical treatment, anodization and application of other coatings. Weld with electrodes and by methods recommended by the aluminum manufacturer in accordance with applicable recommendations of the AWS. Use only methods which will avoid distortion or discoloration of exposed faces. Grind weld areas smooth and restore mechanical finish condition before proceeding with other treatment. No bright aluminum shall be exposed in finished work.
- B. Conceal all fastening unless otherwise shown or specified.
- C. Fit and assemble all work in the shop insofar as practicable. Mark and disassemble units which are too large for shipment to Project site, retaining units in sizes as large as possible for shipment an erection.
- D. Carefully fit and match all work with continuity of line and design, using rigidly secured joints with hairline contact, unless otherwise shown.
- E. Reinforce members and joint with plates, tubes, channels, bars, rods or angles for rigidity and strength as needed or fulfill performance requirements. Use concealed fasteners for jointing which cannot be welded or compression fit.

- F. Separate unlike metals and alloys with a heavy coating of bituminous paint or other suitable permanent separation as required to prevent galvanic action.
- G. At end of each horizontal member where it abuts vertical member provide water dam device properly embedded in approved sealant as required.
- H. Solder and braze only to fill or seal joints (not to form structural joints), and in accordance with component part manufacturer's recommendations. Grind smooth and restore finish.
- I. Deliver fabricated unit and component parts to Project site completely identified in accordance with erection diagrams prepared under this Section. Store in accordance with manufacturer's instructions, above grade, properly protected from the weather and construction activities.

2.7 GLAZING

- A. Provide insulated glass units for curtain wall framing and doors in accordance with requirements specified in Section 088000 – GLAZING.

2.8 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.

2.9 ACCESSORIES

- A. Air Barrier Perimeter Seals: Provide pre-molded, 40 durometer translucent silicone sheets and pre-molded silicone corners and sealant for connecting the entire perimeter of all aluminum framing to the air barrier system. Seals to be attached to both the air barrier and the aluminum frame system to create a continuous airtight seal as shown on the drawings.
 - 1. Accessories: Provide sealants, tape, and fasteners as recommended by air barrier seal manufacturer, and as acceptable to aluminum frame manufacturer.
 - 2. Products: Tremco Proglaze ETA System; Dow Corning 123 Silicone Seal; or approved equivalent.
- B. Sunshades: Provide sunshades in sizes and shapes as indicated.
 - 1. Basis of Design: Versoleil SunShade - Single Blade System by Kawneer, or approved equal.
 - 2. Finish: Provide finish system as specified for curtainwall.
- C. Canopies: Provide canopies in sizes and shapes as indicated.
 - 1. Finish: Provide finish system as specified for curtainwall.

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 insulated glass units in accordance with Section 088000 - GLAZING.

- F. Coordinate with sealants and installation of perimeter sealants which is specified in Section 079200 - JOINT SEALANTS.

- G. Coordinate with materials and installation for perimeter fire-containment systems (safing insulation) which is specified in Section 078400 - FIRESTOPPING.

- H. Coordinate with expansion joint assemblies as specified in Section 079500 - EXPANSION CONTROL.

- 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.
- J. Air Barrier Perimeter Seal: Install the air barrier perimeter seal in accordance with the manufacturer's written installation instructions, including but not limited to folding into glazing channel, cleaning curtain wall frame, and applying recommended sealants.

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 283 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 15-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.
- 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 085110
ALUMINUM WINDOWS

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 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 and operable aluminum-framed windows with factory-installed glass and glazing.

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

- 1. Section 072100 – THERMAL INSULATION for insulation between subframe and window unit.
 - 2. Section 072500 – AIR BARRIERS for air barrier system requirements.
 - 3. Section 079200 - JOINT SEALANTS for installation of joint sealants installed with aluminum window systems and for sealants to the extent not specified in this Section.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide aluminum windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:

- 1. Minimum size required by AAMA/NWWDA 101/I.S.2.

- B. AAMA/NWWDA Performance Requirements: Provide aluminum windows of the performance class and grade indicated that comply with AAMA/NWWDA 101/I.S.2.

- 1. Performance Class: Architectural Grade H-AW80.
 - 2. Performance Grade: Minimum for performance class indicated.
 - 3. Exception to AAMA/NWWDA 101/I.S.2: In addition to requirements for performance class and performance grade, design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch whichever is less.

- C. Structural Performance: Provide aluminum windows capable of withstanding the following, including wind loads based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Structural Test, at basic wind speed indicated and as required by Code:
1. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on structural computations.
 2. Wind and Seismic Loads: As indicated on the Structural Drawings, but not less than that required by Code.
 3. Movements of supporting structure including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads as required by Code. Deflection may require special considerations including but not limited to head receptors.
- D. Air Infiltration: Maximum rate not more than indicated when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
1. Maximum Rate: 0.30 (Maximum) at 6.24psf for Projected Windows; 0.20 (Maximum) at 6.24psf for Fixed Windows
- E. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling that indicated, when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
1. Test Pressure: 15 percent of positive design pressure, but not less than 8.0 lbf/sq. ft. or more than 12 lbf/sq. ft.
- F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 60 for all windows.
- G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to AAMA 1503. U values will be calculated for window type "AL13" as a Basis of Design in this section and determined using a computational procedure in accordance with NFRC 100, through an independent NFRC Accredited Simulator, and based on actual user size of operable and fixed portions of window type "AL13" using a weighted average U value of the fixed and operable components as confirmed by providing a "non-residential fenestration calculation report/ bid report according to NFRC CMA procedures- actual size. Competitors window units must use the specified glazing, or equals, that achieve the minimum U- Values stated below. Submit computational reports, as described above, as proof of compliance.
1. North and East Elev. Overall Window U-Value .40 maximum
 - a. Shading Coefficient: 0.61
 - b. Solar Heat Gain Coefficient: 0.40 maximum
 - c. Daylight Transmission: 70% minimum
 2. South and West Elev. Overall Window U-Value .40 maximum
 - a. Shading Coefficient: 0.41
 - b. Solar Heat Gain Coefficient: 0.30 maximum
 - c. Daylight Transmission: 60% minimum

- H. Solar Heat-Gain Coefficient: Provide aluminum windows with a whole-window SHGC maximum as required by Code, determined according to NFRC 200 procedures. Submit proof of compliance with submittals as specified.

1. SHGC: As indicated above.

- I. Thermal Movements: Provide aluminum windows, including anchorage, that accommodate thermal movements of units resulting from the following maximum change (range) in ambient and surface temperatures without buckling, distortion, opening of joints, failure of joint sealants, damaging loads and stresses on glazing and connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F material surfaces.

1.4 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of aluminum window indicated.

- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, operational clearances, and the following:

1. Scale of shop drawings shall be 6"=1'-0"
2. Mullion details, including reinforcement and stiffeners.
3. Joinery details.
4. Expansion provisions.
5. Flashing and drainage details.
6. Weather-stripping details.
7. Thermal-break details.
8. Custom Extruded panning and sill extensions.
9. Glazing details.
10. Air barrier tie-in connections. Include axonometric representation of installation sequence showing all materials required and method of installation- certified by the manufacturer of the air barrier tie-in system.
11. Window cleaning provisions.
12. Window System Operators: Show locations, mounting, and details for installing operator components and controls.
13. 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 and used to determine the following items. Provide P.E. stamped shop drawings and P.E. stamped calculations for all members and all connections and supports.
 - a. Structural test pressures and design pressures from basic wind speeds indicated.
 - b. Deflection limitations of glass framing systems.

- C. Samples for Verification:

1. Full-size operable window of each type of window with custom panning and sill extensions.
2. Painted metal chips for color verification.
3. Insect screens.

- D. Qualification Data: For Installer, professional engineer and testing agency.
- E. Field Quality-Control Test Reports: From a qualified testing and inspecting agency engaged by Contractor.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, grade, and size of aluminum window. Test results based on use of downsized test units will not be accepted.
- G. Performance Reports: Based on systems, components and glazing methods proposed for use on this Project, proof that windows 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 operable window sash, operating hardware, weather stripping, and finishes to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.
- B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer. Shop Drawings must be prepared by the Window Manufacturer.
- C. Professional Engineer Qualifications: A professional structural 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 windows that are similar to those indicated for this Project in material, design, and extent.
- D. Source Limitations: Obtain aluminum windows through one source from a single manufacturer.
- E. Product Options: Information on Drawings and in Specifications establishes requirements for aluminum windows' 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.
- F. Fenestration Standard: Comply with AAMA/NWWDA 101/I.S.2, "Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors," for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 - 1. Provide AAMA certified aluminum windows with an attached label.
- G. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

- H. 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.
 - 2. In addition to the providing window units for the mock-up panels, provide (1) 4-sided mock-up of the sub-frame receiver system shown on the drawings with integral panning and continuous flange. All corners to be mitered/ coped and sealed.
- I. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:
 - 1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
 - 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 required testing and inspecting procedures.
 - 4. Coordinate interrelationship of aluminum windows with other exterior wall components.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify aluminum window 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 aluminum windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Failure to meet performance requirements.
 - 2. Structural failures including excessive deflection.
 - 3. Water leakage, air infiltration, or condensation.
 - 4. Faulty operation of movable sash and hardware.
 - 5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 6. Insulating glass failure.
- B. Warranty Period for Windows: Ten years from date of Substantial Completion.
- C. Warranty Period for Exterior Metal Finishes: 25 years from date of Substantial Completion.
- D. Warranty Period for Glass: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with all material and performance requirements outlined in these specifications, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Aluminum Windows:
 - a. Architectural Window Manufacturing Corporation.
 - b. Oldcastle Building Envelope, Vistawall –Moduline Signature Series 12ER.
 - c. Wausau- Hertiage Series 3250H.
- B. Basis of Design: Series 3900i Vent Windows as manufactured by Architectural Window Manufacturing Corporation, or approved equal.
- C. New dies, profiles, or customization of stock products will be required to adhere to the specification and detail demands of this project. The cost of any required customization shall be incorporated in the aluminum window bid. No item specified, herein, is the exclusive property of any one manufacturer.

2.2 MATERIALS

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength, not less than 16,000-psi (110-MPa) minimum yield strength, not less than 0.080 inch thickness at any location for the main frame and sash members. Minimum frame depth to be 2 3/4" for window wall system, and 2 3/4" for operable window frame and sash.
- B. Glass Presentation: Exterior glazing stop shall be beveled and shall have a minimum set back to the glass of 7/8" and must be integral to the window frame.
- C. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components.
 - 1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.
 - 2. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.
- D. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Continuous clip angles on the interior side of the window frames are required to receive air barrier membrane. Coordinate installation sequence with section 072500-Air Barrier.
- E. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated.

- F. Compression-Type Weather Stripping: Provide compressible weather stripping designed for permanently resilient sealing under bumper or wiper action and for complete concealment when aluminum window is closed.
- G. Weather Stripping Material: Manufacturer's standard system complying with AAMA/WDMA/CSA 101/1.S.2/A440-05
- H. Replaceable Weather Seals: Comply with AAMA 701/702.
- I. Sealant: For sealants required within fabricated windows, provide window manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement.
- J. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed (products with exposed thermal barriers will not be acceptable), low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal to metal contact.
 - 1. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and, therefore, promote composite action between the exterior and interior extrusions. No thermal short circuits shall occur between the exterior and interior.
 - 2. The thermal barrier shall be INSULBAR or equal, and shall consist of two glass reinforced polyamide nylon 6/6 struts mechanically crimped in raceways extruded in the exterior and interior extrusions.
 - 3. Poured and debridged urethane thermal barriers shall not be permitted.
- K. Receptor (sub-frame): Provide extruded aluminum receptors at heads, jambs and sills, where indicated on Drawings.
 - 1. Receptor construction: Integral design in profile shown on the drawings, equipped with Insulbar glass reinforced thermal break and weatherstripping. Poured and debridged urethane thermal barriers shall not be permitted. Subframe shall incorporate integral panning extension and integral flange on interior of frame to act as a fastening flange and to provide surface for air barrier system connection.
 - 2. All subframes and window frames shall be factory backsealed at all corners and joints to achieve an air and watertight construction.

2.3 GLAZING

- A. Provide insulated standard, sandblasted, and spandrel glass units for aluminum windows in accordance with requirements specified in Section 088000 – GLAZING.
- B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal and is designed to accept insulating glass of specified thicknesses.

2.4 HARDWARE

- A. Hardware Requirements: Provide hardware that complies with AAMA/NWWDA 101/I.S.2.
- B. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with aluminum; designed to smoothly operate, tightly close, and securely lock

aluminum windows and sized to accommodate sash or ventilator weight and dimensions. Do not use aluminum in frictional contact with other metals.

- C. Locks and Latches: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide lever action lift latches except as noted below; one per jamb.
- D. Projected Windows: Provide the following operating hardware: Roto operators.
- E. Hinge: Concealed stainless steel four-bar friction hinge with adjustable-slide friction shoe: two per ventilator.
- F. Provide hardware to limit opening of operable sash to 6" maximum.

2.5 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Provide for each operable sash or ventilator.
- B. 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 adjacent aluminum window members, or as selected by Architect.
- C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch.
 - 1. Color: Provide black, charcoal or other Architect approved color as selected from manufacturer's full range.
- D. Screen Location: Must be designed to fit at the Interior. Screens mounted to the inside of window frame surface and held in place with applied clips. Wickets shall not be acceptable.

2.6 FABRICATION

- A. General: Fabricate aluminum windows, 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 windows.
- B. Thermally Improved Construction: Fabricate aluminum windows with an integral, concealed, low-conductance thermal barrier; located between exterior materials and window members exposed on interior side; in a manner that eliminates direct metal-to-metal contact.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, compatible with all small joint sealants, and in direct continuous contact with window frame. Use of paper or cloth patches to separate gasket from sealant applied to window frame are not acceptable.
- D. Weep Holes: Provide concealed weep holes and internal passages to conduct infiltrating water to exterior.

- E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- F. Factory-Glazed Fabrication: Glaze aluminum windows in the factory where practical and possible for applications indicated. Comply with AAMA/NWWDA 101/I.S.2.

2.7 ACCESSORIES

- A. Air Barrier Perimeter Seals: Provide pre-molded, 40 durometer translucent silicone sheets and pre-molded silicone corners and sealant for connecting the entire perimeter of all window units to the air barrier system. Seals to be attached to both the air barrier and the window frame system to create a continuous airtight seal as shown on the drawings.
 - 1. Accessories: Provide sealants, tape, and fasteners as recommended by air barrier seal manufacturer, and as acceptable to window manufacturer.
 - 2. Products: Tremco Proglaze ETA System; Dow Corning 123 Silicone Seal; or approved equivalent.

2.8 FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish system for all aluminum components shall be factory applied after proper preparation. Thoroughly clean all surfaces; remove all blemishes, dents, abrasions, scratches, and tool marks from surfaces which will be exposed to view.
- C. Exterior Finish of all exposed aluminum furnished under this Section, shall be "Kynar 500", "Duranar XL", "Fluoropon", or equal as approved. Provide a 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. Custom colors shall be selected by Architect. At the exterior, two (2) colors will be required, one for operable sash, and one for the fixed frame. At the interior, one (1) color will be required for operable and fixed frame. Custom colors chosen will be "non-exotic" but will include mica-metallic finish options. Minimum dry film thickness: 1.5 mils. Interior Finish: PPG Duracron in accordance with AAMA 2603 averaging 0.8 mil dryfilm thickness; Pencil hardness, in accordance with ASTM D3363, to be H minimum.
- D. Interior Finish:
 - 1. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - 2. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603.

3. Color: Provide custom color as selected by Architect.
- E. For Painted Finish: At concealed surfaces use AA-C40 with factory wash primer and shop coat of zinc-chromate primer, or other preparation approved by finish manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances; rough opening dimensions; levelness of sill plate; coordination with wall flashings, vapor retarders, and other built-in components; operational clearances; and other conditions affecting performance of work.
 1. Masonry, and Precast Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
 2. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- E. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified in "Dissimilar Materials" Paragraph in Appendix B in AAMA/NWWDA 101/I.S.2.
- F. Air Barrier Perimeter Seal: Install the air barrier perimeter seal in accordance with the manufacturer's written installation instructions, including but not limited to fastening the air barrier seal to window unit, cleaning adaptor and window frame, and applying recommended sealants.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports. Costs of initial testing / inspection will be the responsibility of the Owner. Cost of additional tests required due to failure to comply with initial tests will be done at the Contractor's expense until compliance is achieved.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502, Test Method A, by applying same test pressures required to determine compliance with AAMA/NWWDA 101/I.S.2 in Part 1 "Performance Requirements" Article.
2. Testing Extent: Three windows as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested immediately after installation.
3. Test Reports: Shall be prepared according to AAMA 502.

C. Remove and replace windows where test results indicate that they 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.

3.4 ADJUSTING

- A. Adjust operating sashes and ventilators, screens, hardware, operators, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.5 PROTECTION AND CLEANING

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- B. Clean aluminum surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 086200

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.
- 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 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 dome skylights at roof.
- B. 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 Contracting Officer 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. Shop Drawings: Submit complete shop drawings of all work of this Section to Contracting Officer 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, and other like items, 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 Contracting Officer 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. Acralight Solar.

2. Bristolite.
3. Wasco, EcoSky3.
4. Or approved equal.

- B. Basis of Design: Provide Coollite ALT-SF-2 as manufactured by Bristolite, or approved equal.

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 and translucent as selected by Architect. Outside acrylic panel shall be high impact type to withstand 200 lb. load as required by OSHA.
7. Glazing Performance Requirements: Comply with minimum requirements of ASHRAE 90.1-2004, and as follows:
 - a. U-value: 0.45 minimum.
 - b. Solar Heat Gain Coefficient (SHGC): 0.34 maximum.
 - c. Visible Light Transmission (VLT): 43%, minimum.
 - d. VLT/SHGC: 1.25 or better.
8. Curb: Self-flashing curb, 12 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.
- 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 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.
- B. Related Work: The following items are not included in this Section and will be performed 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.

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. 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 project location responsible for their preparation.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- D. 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.
- E. Field quality-control test and inspection reports.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for metal-framed skylights.
- G. Maintenance Data: For metal-framed skylights to include in maintenance manuals.
- H. 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. Architectural Skylight Co., Inc.

2. Kawneer.
3. LinEI Signature.
4. Naturalite Skylight Systems; Vistawall Group.
5. Skyline Products, Inc.
6. Wasco Products, Inc.

- B. Basis of Design: Provide products as manufactured by Wasco Products, Inc.; or approved equal.

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.

- 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. Insulating-Glass Units for Sloped Glazing (Skylights):

1. Provide insulated glass units in accordance with requirements 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 088000

GLAZING

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 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. Glazing at display cases.
 - c. Unframed mirrors.
 - d. Wood doors specified in Section 081400 FLUSH WOOD DOORS.
 - e. Fire rated glass, framing, and door systems.
 - f. Interior butt-glazed glass partitions with mounting hardware.
 - g. As indicated.

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

- 1. Section 084410 - GLAZED ALUMINUM CURTAIN WALLS for field glazing for aluminum framing.
- 2. Section 085110 - ALUMINUM WINDOWS for factory glazing for metal windows.

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. 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.
- C. 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.
- D. 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.
- E. Qualification Data: For installers.
- F. 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.
- G. Product Test Reports: For each of the following types of glazing products:

1. Tinted float glass.
2. Coated float glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing gaskets.

H. 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, according to ASTM E 329.
 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 Door 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.

- H. Safety Glazing Products: Comply with testing requirements in 16 CFR 120.
 - 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. Available Glazing Manufacturers and Fabricators: Guardian, PPG, Viracon, or approved equal.
- B. Typical Insulating Glass Units, Double Glazed with Double Low-E:
 - 1. Thickness 1"
 - a. Outer Light: 1/4" tempered clear glass with Low-E coating on #2 surface
 - b. 1/2" argon space (10% air, 90% Argon) with dark spacer.
 - c. Inner Light: 1/4" tempered clear glass
 - 2. Performance
 - a. U-value: Less than or equal to 0.25
 - b. Solar Heat Gain Coefficient: Less than or equal to 0.39
 - c. Visible light Transmittance: Greater than or equal to 68%
 - 3. Low-E coatings:
 - a. Edge Delete: Omit Low-E coating 1/4" from edge of lite around full perimeter.
 - b. Coating Products:
 - 1) Guardian SunGuard SN 68

- 2) PPG SolarBan 60
 - 3) Viracon VE-2M
 - C. Insulating Glass Units at interior vestibule:
 - 1. Thickness 1"
 - a. Outer Light: 1/4" tempered clear glass
 - b. 1/2" argon space (10% air, 90% Argon) with dark spacer
 - c. Inner Light: 1/4" tempered clear glass
 - 2. Performance
 - a. Visible light Transmittance: Greater than or equal to 80%
 - D. Spandrel Insulated Glass Units.
 - 1. Provide glass assembly similar to Type B and C as specified above except for the following:
 - a. Color Ceramic Frit: Applied to third surface.
 - 1) Color: Provide from manufacturer's standard colors as selected by Architect.
 - b. Ceramic-Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent flat glass), Quality-Q3, and complying with other requirements specified.
 - E. Translucent Insulated Glass Units: Provide insulated glass units as specified herein above with sandblasted finish on the third surface. Match Architects sample.
- 2.2 GLASS PRODUCTS
- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
 - B. 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).
 - C. 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.
- 2.3 INTERIOR GLAZING
- A. Standard Float Glass: As specified above.
 - B. Tempered Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; Kind FT; 1/4 inch thick unless indicated otherwise.
 - C. 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.
 - D. 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.
5. Construction for laminated glass shall be: 3/8" glass, 0.030 inter layer, 1/4" glass minimum thickness. Provide tempered glass as indicated on drawings or as required by code. Provide thicker glass for large panes if necessary and required by code and other regulations.

- E. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process, with silver coating.

1. Thickness: 1/4 in. thick glass
2. Mirror Edge Treatment: Flat polished edge.
3. Manufacturers:
 - a. Guardian UltraMirror
 - b. Virginia Glass Mirror Co.
 - c. Laurier Glass
 - d. Approved equal.

2.4 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

- B. Monolithic Ceramic Glazing, General: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); Premium FireLite.
 - b. Schott North America, Inc.; Pyran Crystal.
 - c. Vetrotech Saint-Gobain; SGG Keralite FR-R.

- C. Laminated Ceramic Glazing (for rated locations where safety glazing is required by code): Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch (8-mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); Fire Lite Plus.
 - b. Schott North America, Inc.; Laminated Pyran Crystal.
 - c. Vetrotech Saint-Gobain; SGG Keralite FR-L.

- D. Fire-Rated Laminated Ceramic Glazing Material with Frames and Doors: 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. Laminated Glass with Intumescent Interlayers: 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.
 - a. Products: Subject to compliance with requirements, provide the following, or approved equal:
 - 1) InterEdge, Inc., a subsidiary of AFG Industries, Inc.; Pyrobel.
 - 2) (Basis of Design) Pilkington Group Limited (distributed by Technical Glass Products); PyroStop.
 - 3) Vetrotech Saint-Gobain; SGG Contraflam N2 or SGG Swissflam N2.
 - b. Glazing with waves, ripples, dimples, and other defects is not permitted.
 4. Frames and Doors: Provide the following door and frame types as manufactured and supplied by Technical Glass Products (TGP), or approved equal:
 - a. Provide TGP, Fireframes Aluminum Series fire-rated frames and doors or approved equal.
 - 1) Steel Frame: Steel framing members made of two halves, nom. 1.916 in. wide (48 mm) with a nom. minimum depth of 1.3 in. (33 mm) with lengths cut according to glazing size.
 - 2) Aluminum Trim — Supplied with the steel framing members. Nom. 1-916 in. (40 mm) wide with a nom. depth of 1.3 in. (33 mm) with lengths cut according to glazing size.
 - 3) Stainless Steel Spacers — Supplied with the steel framing members. Nom 3/8 in. (9.5 mm) diameter with a nom. minimum depth of 1-1/16 in. (23 mm) with depth adjusted to match glass thickness.
 - 4) Framing Member Fasteners — Supplied with the steel framing members. Screws have a nom. ¼ in. (6.35 mm) diameter with a minimum length of 2.363 in. (60 mm). Screws to be sized to accommodate the thickness of the fire resistant glazing material.
 - 5) Glazing Tape — Supplied with the steel framing members. Nom. ½ in. (12.7 mm) by ¼ in. (6.5 mm) closed cell PVC glazing tape applied to the steel framing members to cushion and seal the glazing material when installed.
 - b. Typical locations: Provide TGP, Fireframes Designer Series fire-rated frames and doors.
 - 1) Steel: Profiled steel tubing formed using cold drawn and profiled steel tubing.
 - 2) Fasteners: As recommended by manufacturer
 - c. Design Requirements:
 - 1) Dimensions – Door and Framing:
 - a) Door framing face dimension: 1 15/16-inch.
 - b) Depth of door framing: 1 15/16-inch.
 - c) Door style face dimension: 3 1/8-inch.
 - d) Door cross rail (if applicable) face: 3 9/16-inch.
 - e) Depth of stile, header, sill and cross rail: 1 15/16-inch
 - 2) Dimensions -- Window Assembly:
 - a) Perimeter framing face dimension: 2 3/4-inch at head, sill and jamb.
 - b) Horizontal and/or vertical mullions: 3 9/16-inch on the face.

- c) Depth of perimeter and mullion: 1 15/16-inch.
- 3) Construction: Narrow-profile, roll-formed steel architectural grade specialty fire doors. Conventional break-shape type hollow metal steel fire-rated doors will not be considered an acceptable substitute for the Fireframes Designer Series doors specified in this section as they do not conform to the project design intent and/or aesthetic and quality standards.
 - a) Knock down frames are not permitted.
- d. Factory prepare steel door assemblies and install all hardware.
- e. Accessories: Provide angles, tapes, sealants, anchors, and other accessories as required for a complete rated assembly.
 - 1) Refer to drawing details.
- f. Hardware:
 - 1) Electric Mortise Lock and Electric Hinge. Trim to be selected by Architect from full range available.
 - 2) Mechanical, Exit Only Device (Von Duprin 98EO).

2.5 INTERIOR GLASS PARTITIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Blum, Julius & Co., Inc.
 - 2. C.R. Laurence Co., Inc.
 - 3. Livers Bronze Co.
- B. Basis of Design: Provide products as manufactured by C.R. Laurence Co., Inc.; or approved equal.
 - 1. C.R. LAURENCE CO. INC.:
 - a. Bottom Channel: CRL Catalog Number: WU3SASL, or approved equal.
 - b. Top Channel: CRL Catalog Number: WU1SASL, or approved equal.
 - c. Finish: Satin anodized.
- C. Provide 1/2 inch tempered laminated glass at typical locations, and 3/4 inch tempered laminated glass where glass is within 18 inches of the floor and/or over 5'-0" high.
- D. Provide rated assemblies where fire rating is indicated.
- E. Accessories: Provide channels, fittings, gaskets, anchors, and all components as recommended by manufacturer for a complete glass partition system. Refer to Drawings for details.

2.6 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.

2.7 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.
 1. Openings 9 square feet or less: Provide 440 Tape as manufactured by Tremco, or approved equal.
 2. Openings over 9 square feet: Provide Polyshim II Tape as manufactured by Tremco, or approved equal.
 - a. Properties: Cross-linked butyl preformed tape with a continuous integral EPDM shim.
 3. Thickness: As recommended by manufacturer for application.
- 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.

2.8 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.

2.9 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.
 - 1. Coordinate Mirrors with electrical power plans, provide outlet cutouts as required.

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 INSTALLING GLASS PANELS

- A. Glass Partitions: Install assembly to comply with manufacturer's written instructions.
 - 1. Attach base channel to building structure, then insert and connect factory-fabricated and -assembled glass panels.
 - a. Support glass panels in base channel at quarter points with channel-shaped setting blocks that also act as shims to maintain uniform space for glazing cement. Fill remaining space in base channel with glazing cement for uniform support of glass.
 - 2. Adjust spacing of glass panels so gaps between panels are equal before securing in position.
 - 3. Erect glass partitions under direct supervision of manufacturer's authorized technical personnel.
- B. Fire-rated Frames: Install assembly to comply with manufacturer's written instructions.
- C. Hollow Metal Glazing: Comply with hollow metal manufacturer's written instructions.
 - 1. Remove stops for installation of glazing. Install glazing and 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.

3.7 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.
- 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 the following:
 - 1. Fixed, extruded-aluminum storm class high-performance, exterior louvers.
- B. Related Sections include the following:
 - 1. Section 072100 – THERMAL INSULATION, for insulation between frame and air barrier membrane.
 - 2. Section 072500- AIR BARRIERS, for air barrier tie-in requirements.
 - 3. Section 079200 – JOINT SEALANTS, for sealant at exterior perimeter of louver frame.
 - 4. Mechanical systems to be connected to louvers, and modification of blank-off panels: Section 230000– HEATING, VENTILATING AND AIR CONDITIONING.

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. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act on vertical projection of louvers.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- B. Seismic Performance: Provide louvers capable of withstanding the effects of earthquake motions determined according to seismic criteria indicated on the Drawings
- 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 (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Air-Performance, Water-Penetration, Air-Leakage, and Wind-Driven Rain Ratings: Provide louvers complying with performance requirements indicated, as demonstrated by testing manufacturer's stock units per AMCA 500-L.

1.5 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Product Data: For each type of product indicated. Include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- 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 and vents 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 Initial Selection: For units with factory-applied color finishes.
- E. Samples for Verification:
 1. For each type of metal finish required.
- F. Qualification Data: For professional engineer for units indicated to required to be engineered to meet structural performance.
- G. 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."
 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
- 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.

1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components and materials 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.
 2. Warranty Period: One year 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 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T5 or 6063-T6.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Support angles: 2 inch (25 mm) by 2 inch (38 mm) continuous extruded aluminum angles, pre-drilled with holes for attachment to louver.
- D. 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.
1. Use types and sizes to suit unit installation conditions.
- E. 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.

- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 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. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Horizontal Mullions: Provide horizontal mullions at joints where indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- E. Fabricate sub-sill flashing of minimum 0.060" aluminum with end dams in custom profile with finish to match louver indicated on Drawings. Pre-drill holes in sub-sill for fasteners in vertical surfaces only.
- F. Include continuous clip angles, supports, anchorages, and accessories required for complete assembly.
- G. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
 - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.
- I. Join frame members to each other and to fixed louver blades with fillet welds, threaded fasteners, or both, as standard with louver manufacturer, concealed from view, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED EXTERIOR LOUVERS

- A. Fixed, Extruded Aluminum, Horizontal Storm Class High Performance Louvers:
 - 1. Louver Depth: 5 inches (127 mm), unless indicated otherwise.
 - 2. Frame and Blade Nominal Thickness: Minimum thickness for frame to be 0.081" (for 6063-T5) or 0.080" (for 6063-T6). Minimum thickness for blades to be 0.081" (for 6063-T5) or 0.060" (for 6063-T6).
 - 3. Performance Requirements:

- a. Free Area: Not less than 6.80 square feet, 42.5 percent free area for 48-inch- (1.2-m-) wide by 48-inch- (1.2-m-) high louver.
 - b. Air Performance: Not more than 0.18 in. H₂O (0.045 kPa) pressure drop.
 - c. Class A.
 4. Wind-Driven Rain Performance: Not less than
 - a. Low Weather Condition: 99 percent effectiveness when subjected to a rain fall rate of 3 inches (75 mm) per hour and a wind speed of 29 mph (13 m/s) at a core area intake velocity of 876-fpm (4.5-m/s).
 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
- 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. McDermott Metal Works Corporation, Lakeville MA; Model M-545 ECD.
 2. Airolite Company, *SCH501 Storm Class Louver*.
 3. Construction Specialties Inc.: Model RS-5300.
 4. Approved equal.

2.4 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 (150 mm) from each corner and at 12 inches (300 mm) o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
1. Metal: Same kind and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 2. Finish: Mill finish.
 3. Type: Removable, non-rewirable, U-shaped frames for permanently securing screen mesh.
- D. Louver Screening for Aluminum Louvers:
1. Bird Screening: Aluminum, 1/2-inch- (12.7-mm-) square mesh, 0.050-inch wire.

2.5 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. Locations: Behind each exterior louver.
 2. Thickness: 2 inches (51 mm).
 3. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch (0.8-mm) nominal thickness.
 4. Insulating Core: Unfaced mineral-fiber rigid insulation board.
 5. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's

standard extruded-aluminum-channel frames, not less than 0.080-inch (2.0-mm) nominal thickness, with corners mitered and with same finish as panels.

6. Seal perimeter joints between panel faces and louver frames with 1/8-by-1-inch (3.2-by-25-mm) PVC compression gaskets.
7. Panel Finish: Same type of finish applied to louvers, but black color.
8. Attach blank-off panels to back of louver frames as required for watertight assembly.

2.6 ACCESSORIES

- A. Sealant: For sealants required within fabricated louvers, provide louver manufacturer's standard, permanently elastic, nonshrinking, and nonmigrating type recommended by sealant manufacturer for joint size and movement. All joints in louver unit components shall be back sealed with high performance sealant suitable for metal to metal joints that can withstand movement and linear expansion and contraction to achieve a perimeter airtight frame.
- B. Butyl Tape: For air barrier tie-in connection, Tremco 4400 Tape or approved equivalent compatible with air and vapor barrier.
- C. Air Barrier Perimeter Seals: Provide pre-molded, 40 durometer translucent silicone sheets and pre-molded silicone corners and sealant for connecting the entire perimeter of all louver units to the air barrier system. Seals to be attached to both the air barrier and the louver frame system to create a continuous airtight seal as shown on the drawings.
 1. Accessories: Provide sealants, tape, and fasteners as recommended by air barrier seal manufacturer, and as acceptable to louver manufacturer.
 2. Products: Tremco Proglaze ETA System; Dow Corning 123 Silicone Seal; or approved equivalent.

2.7 GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish louvers after assembly.

2.8 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.
- 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 Two-Coat Coating System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
 - a. Color and Gloss: Custom color as selected by Architect to match windows.

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. Secure louvers to adjacent construction using continuous angles on entire perimeter of frame.
- D. Form closely fitted joints with exposed connections accurately located and secured.
- E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- F. 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.
- 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.
- H. Coordinate with section 072500-Air Barrier for louver-wall tie-in to achieve a continuous air barrier.
- I. Connections: Coordinate louver installation with the Work of Section 230000 – Heating, Ventilating and Air Conditioning, who will cut holes in louver blank-off plates to match connecting ductwork. Install louver blank-off plates for watertight and airtight assembly.
- J. Air Barrier Perimeter Seal: Install the air barrier perimeter seal in accordance with the manufacturer's written installation instructions, including but not limited to folding into glazing channel, cleaning louver frame, and applying recommended sealants.

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 090160

VAPOR MITIGATION AT SLABS

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 carpet locations.
- B. Related Sections include the following:
 - 1. Section 033000 – CAST-IN-PLACE CONCRETE for slab curing methods.

1.3 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Qualification Data: For Installer.
- C. Field quality-control test reports.
- D. 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 manufacturer's representative in accordance with the manufacturer's recommendations. Tests shall be approved by the manufacturer's representative.
- D. Preinstallation Conference: Conduct preinstallation conference at project site with General Contractor, moisture mitigation installer, resilient flooring sub-contractor, Architect, and Owner's representative to review requirements for installation and compatibility with specified resilient flooring adhesive.

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. Koester American Corporation; Koester VAP 1 2000 System.
 - 3. Approved equal.

2.2 MATERIALS

- A. General: Use materials of one manufacturer throughout the project as hereinafter specified. Product shall be compatible with specified resilient flooring manufacturers recommended adhesive.
- 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.

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

- 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 of 2.4:1 by volume.

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. Perform relative humidity testing in accordance with requirements of Section 096820 – CARPETING.

- 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. Clean all surfaces to receive moisture vapor reduction system as recommended by manufacturer. Shot blast floors and 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 bee bees, and other items. 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. Acid etching will not be accepted.
- C. Repair concrete prior to moisture vapor reduction system installation as recommended by manufacturer.

3.3 APPLICATION

- A. System Application: Apply moisture mitigation system in accordance with manufacturers requirements and in thickness as required to achieve relative humidity tolerances as specified in Section 096820 – CARPETING.

3.4 CLEANING

- A. Remove debris resulting from water vapor reduction system installation from project site.

3.5 PROTECTION

- A. Protect each coat during specified cure period from any kind of traffic, topical water and contaminants.

END OF SECTION

SECTION 092900

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 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 the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backer panels.
 - 3. Cement board panels for exterior soffits and interior shower areas.
 - 4. Non-load-bearing steel framing.
 - 5. Heavy gauge steel framing for interior applications.
 - 6. Shaft wall construction.
 - 7. Acoustic materials and insulation.
- B. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Section 210001 - FIRE PROTECTION:
 - a. Access doors in gypsum board assemblies.
 - 2. Section 220001 - PLUMBING:
 - a. Access doors in gypsum board assemblies.
 - 3. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Access doors in gypsum board assemblies.
 - b. Pipe and duct sleeves for placement into gypsum board openings.
 - 4. Section 260001 - ELECTRICAL WORK:
 - a. Access doors in gypsum board assemblies
- C. Related Sections include the following:
 - 1. Section 061000 – ROUGH CARPENTRY, for wood framing, furring and for blocking to be installed in gypsum wallboard partitions.
 - 2. Section 078400 – FIRESTOPPING, for filling voids in gypsum wallboard systems as required to maintain fire-rated construction.
 - 3. Section 093000 – TILING, for ceramic tile installation materials.
 - 4. Section 099000 – PAINTING AND COATING, for painting.

5. Section 081110 – HOLLOW METAL DOORS AND FRAMES for acoustic insulation in hollow metal frames.

1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 INDOOR AIR QUALITY REQUIREMENTS

- A. Volatile Organic Compounds: All products specified in this section shall comply with the following limits on content of VOC's when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 1. Adhesive: Maximum 50 grams/liter total VOC's
 2. Sealant: Maximum 250 grams/liter total VOC's
- B. Formaldehyde: No product specified in this section shall contain added urea-formaldehyde resins. Total formaldehyde content shall not exceed ANSI A208.1-1993 emission standard of 0.20 ppm of formaldehyde.
- C. No sealant specified in this section for interior installation shall contain aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium or hexavalent chromium.

1.5 SUBMITTALS

- A. General: Prepare and submit shop drawings, samples, informational and other submittals in accordance with the requirements of Section 013300 – SUBMITTAL PROCEDURES.
- B. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- C. Samples: For the following products:
 1. Framing Components: Full-size sample in 12-inch- (300-mm-) long length for each trim framing component indicated.
 2. Board Materials: 8-inch (203-mm) by 10-inch (254-mm) sample of each type of wall board and backer board.
 3. Trim Accessories: Full-size sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
- D. IAQ Submittals: For each product that contains VOC's, or is otherwise regulated under OSHA Hazard Communication Standard 1610.1200, comply with submittal requirements specified in Section 018119 – Indoor Air Quality Control.

1.6 QUALITY ASSURANCE

- A. General: Provide wallboard materials from a single manufacturer. Fasteners, adhesives, joint

compounds and other accessory materials shall be as recommended by approved wallboard manufacturer.

- B. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, 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 UL's "Fire Resistance Directory."
- C. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
 - 1. STC-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.
- C. Hanger Attachments to Concrete: As follows:
 - 1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- D. Hangers: As follows:

1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
 2. Flat Hangers: Commercial-steel sheet, ASTM A 366/A 366M, with corrosion-resistant paint finish.
Size: 1 by 1/8 inch (25.4 by 3.2 mm) by length indicated.
 3. Acoustic Isolation Hangers: Neoprene element and spring types, with rings top and bottom for hanger wire or strap attachment for ceiling suspension
STC shall not exceed 14.
 4. Spring Type Product:
 - a. Mason Industries; Type W30N
 - b. Kinetics Noise Control; Muta Spring.
 - c. Novia Associates, Inc; equal product.
 - d. Approved equal.
 5. Neoprene Type (for direct attachment to floor structure):
 - a. Mason Industries; Type CRC-H
 - b. Kinetics Noise Control; IsoGrid.
 - c. Novia Associates, Inc; equal product.
 - d. Approved equal.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch (1.37 mm), a minimum 1/2-inch- (12.7-mm-) wide flange, with manufacturer's standard corrosion-resistant zinc coating.
1. Depth: 1-1/2 inches (38.1 mm).
- F. Furring Channels (Furring Members): Commercial-steel sheet with manufacturer's standard corrosion-resistant zinc coating.
1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
 - a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
 - b. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep members designed to reduce sound transmission.
 - c. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.
- G. Grid Suspension System for Interior 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.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation; Double-Web Direct Hung Drywall System 650/670.
 - c. USG Interiors, Inc.; Drywall Suspension System.

2.2 STEEL PARTITION AND SOFFIT FRAMING

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ClarkDietrich Industries.
 2. MarinoWARE.
 3. Super Studs Building Products, Inc.[]
- B. Components, General: As follows:
1. Comply with ASTM C 754 for conditions indicated.

2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal
 - a. Zinc coating for typical applications: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized zinc coating.
 - b. Zinc coating for wet locations: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized zinc coating.
- C. Steel Studs and Runners: ASTM C 645.
 1. Minimum Base Metal Thickness for Typical Locations: 20-gauge studs, 0.0312 inch (0.79 mm) thick.
 2. Stud Framing shall be provided to meet a designed load calculated for a deflection not exceeding $L/360 @ 5$ psf.
 - a. Provide heavier gauge studs where required engineered in accordance with section 054000.
 - b. Provide heavier gauge metal stud framing at metal acoustic door frames, where indicated, and as required to properly frame conditions where long spans or excessive loading is anticipated.
 - c. Provide 18 gauge (minimum) studs at typical door jambs where framing is greater than 14' in height.
 3. Depth: As indicated.
 4. Dimpled Steel Studs and Runners (Contractor's Option): Dimpled steel studs and runners may be provided in lieu of standard steel studs and runners, in accordance with requirements as specified hereinabove.
 - a. Minimum Base Metal Thickness for Typical Locations: 25 gauge EQ, 0.015" bare metal, 0.034" dimple to dimple.
 - b. Provide heavier gauge metal stud framing for locations as noted above.
 - c. Depth: As indicated.
- D. Deep-Leg Deflection Track: ASTM C 645 top runner with 2-inch- (50.8-mm-) deep flanges.
- E. Cold-Rolled Channel Bridging: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.
 1. Depth: 1-1/2 inches (38.1 mm).
 2. Clip Angle: 1-1/2 by 1-1/2 inch (38.1 by 38.1 mm), 0.068-inch- (1.73-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
 2. Depth: 7/8 inch (22.2 mm).
- G. Resilient Furring Channels: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical or hat shaped, with face attached to single flange by a slotted leg (web) or attached to two flanges by slotted or expanded metal legs.
- H. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flange.
 1. Depth: As indicated.
 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare steel thickness of 0.0312 inch (0.79 mm).
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare metal thickness of 0.0179 inch (0.45 mm), 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.

2.3 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Typical, Gypsum Wallboard: ASTM C 36, ASTM C 1396 Section 5.
 - 1. Type X:
 - a. Thickness: 5/8 inch (15.9 mm).
 - b. Long Edges: Tapered.
 - c. Location: Typical locations.
 - 2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia Pacific Gypsum; ToughRock Fireguard Type X.
 - b. National Gypsum Co.; Gold Bond Fire Shield Type X.
 - c. LaFarge North America Inc.; Firecheck Type X.
 - d. United States Gypsum Corp; Sheetrock Firecode Type X.
- C. Special Fire-Resistive Type: ASTM C 36 and ASTM C 1396 Section 5, having improved fire resistance over standard Type X.
 - 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. Georgia Pacific Gypsum Corp.; ToughRock Fireguard C.
 - b. National Gypsum Company; Gold Bond Fire-Shield C.
 - c. LaFarge North America Inc; Firecheck Type C.
 - d. United States Gypsum Co.; SHEETROCK Gypsum Panels, FIRECODE C Core.
 - 2. Thickness: 5/8 inch (15.9 mm).
 - 3. Long Edges: Tapered.
 - 4. Location: As indicated or where required for specific fire-resistance-rated assembly indicated.

2.4 MOISTURE AND MOLD RESISTANT BOARD

- A. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396, Section 7. With moisture- and mold-resistant core and paper surfaces.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia Pacific Gypsum; ToughRock Mold-Guard Type X.
 - b. National Gypsum Co.; Gold Bond XP Fire-Shield.
 - c. LaFarge North America Inc.; Mold-Defense Type X.
 - d. United States Gypsum Corp; Sheetrock Mold-Tough Firecode X.
 - 2. Core: 5/8 inch, Type X.
 - 3. Long Edges: Tapered.
 - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

5. Location: As indicated and where required for mold and moisture resistance.

2.5 ABUSE AND IMPACT RESISTANT GYPSUM BOARD SYSTEMS

- A. Abuse-Resistant Panels: ASTM 1629, Abrasion Resistance Level 3.
 1. Locations: As indicated on Drawings.
 2. Fire-rating: Meets requirements of ASTM C1278 for Type X.
 3. Thickness: 5/8 inches (16 mm).
 4. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. LaFarge North America Inc.; Protecta AR 100 Type X with Mold Defense.
 - b. National Gypsum Co.; Gold Bond Hi-Abuse XP.
 - c. Georgia Pacific Gypsum; DensArmor Plus Abuse-Resistant Type X.
- B. Impact-Resistant Panels: ASTM 1629, Abrasion Resistance Level 3, Soft-Body impact Level 3, Hard-body impact Level 2 minimum.
 1. Locations: As indicated on Drawings.
 2. Fire-rating: Meets requirements of ASTM C1278 for Type X.
 3. Thickness: 5/8 inches (16 mm).
 4. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. LaFarge North America Inc.; Protecta HIR 300 Type X with Mold Defense.
 - b. National Gypsum Co.; Gold Bond Hi-Impact XP.
 - c. Georgia Pacific Gypsum; DensArmor Plus Impact-Resistant Gypsum Board Type X.
- C. Special Accessories for Use with Abuse and Impact Resistant Panels:
 1. Tape: Heavy-duty tape formulated for use with abuse and impact resistant board.
 2. Joint compound: As recommended by manufacturer for use in a Level 5 finish on approved abuse and impact resistant wallboard system.

2.6 TILE BACKING PANELS

- A. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Georgia Pacific Gypsum; ToughRock Mold-Guard Type X.
 - b. National Gypsum Co.; Gold Bond XP Fire-Shield.
 - c. LaFarge North America Inc.; Mold-Defense Type X.
 - d. United States Gypsum Corp; Sheetrock Mold-Tough Firecode X.
 2. Core: 5/8 inch, Type X.
 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 4. Locations: Use behind tile in non-wet areas and other areas indicated on drawings.
- B. 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. National Gypsum Company; Permabase Cement Board.
 - b. United States Gypsum Corp; DUROCK Cement Board.

- c. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
- 2. Thickness: 5/8 inch.
- 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- 4. Locations: Use behind tile in wet areas: Showers, and other areas indicated on drawings.

2.7 PANELS FOR EXTERIOR CEILINGS AND SOFFITS

A. Cement Board Stucco System:

- 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. BASF Synergy Cement-Board Stucco 1000.
 - b. STOQuick Silver NExT Sytem.
 - c. Parex, USA; Lahabra Nutech Stucco.
 - d. Approved equal.
- 2. Cement Board: Non-combustible, water-durable cement-based board product.
 - a. Core material: Aggregated portland cement.
 - b. Facing: Polymer-coated glass-fiber mesh embedded in both surfaces.
 - c. Edge Treatment: Glass-fiber mesh wrapped around all panel edges.
 - d. Thickness: 1/2-inch, unless otherwise indicated or required;
 - e. Panel size: As selected to minimize cutting.
 - f. Product: As acceptable to manufacturer.
- 3. Stucco finish:
 - a. Reinforcing mesh: Self-adhering open-weave glass fiber mesh with twisted multi-end strands treated for compatibility with all components with which it will be in contact.
 - 1) Product: BASF, Synergy *Self-Adhering Reinforcing Mesh* or equal by manufacturer of cement board system.
 - b. Base Coat: Dry-mix polymer adhesive and base coat containing portland cement, for field-mixing with water only.
 - 1) Product: BASF, Synergy *Alpha Base Coat* or equal by manufacturer of cement board system.
 - c. Tinted Primer: 1005 acrylic-based primer with color to match finish color selected for finish coat.
 - 1) Product: BASF, Synergy *Tinted Primer* or equal by manufacturer of cement board system.
 - d. Finish Coat: 100% acrylic resin finish, air-cured, with factory-mixed pigments.
 - 1) Finish Texture: Fine.
 - 2) Color: As selected by Architect from manufacturer's standard range.
 - 3) Product: BASF, Synergy *Finish Coat* or equal by manufacturer of cement board system.
- 4. Accessories for Use with Cement Board:
 - a. Water barrier: As recommended by manufacturer of cement board system.
 - b. Screws: Steel screws with corrosion-resistant coating, with wafer head design, lengths as recommended by cement board manufacturer.
 - c. Tape: Alkali-resistant, polymer-coated open glass-fiber mesh tape formulated for use with cement board.
 - d. Starter track, edge beads, expansion joints and other accessories as required for a complete installation meeting the requirements of the cement board system manufacturer. Manufactured by ClarkDietrich, MarinoWARE, or equal.

2.8 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Acceptable Manufacturers:
 - a. Clark Dietrich
 - b. MarinoWARE
 - c. USG Corp
 - d. Trim-Tex Drywall Products
 - e. Or Equal
 - 2. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 3. Shapes:
 - a. Cornerbead: Use at outside corners. ClarkDietrich #103 Deluxe, or equal.
 - b. L-Bead: L-shaped; exposed long leg receives joint compound; use where indicated. ClarkDietrich #200-B, or equal
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot; Use where indicated and at locations required per ASTM C-840. ClarkDietrich #093, or equal.
 - d. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges. Use where indicated. ClarkDietrich #200-A, or equal.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound; use where indicated. ClarkDietrich #400, or equal.
 - f. Bullnose Bead; use where indicated.
 - 4. Vinyl Trim:
 - L-Bead Trim with Tear-Away strip. May be used at conditions within typical class-rooms and administrative offices only. ClarkDietrich Rip-Bead L-Trim, or equal.
- B. Trim for areas to receive veneer plaster or level 5 finish: ASTM C 1047.
 - 1. Material: Galvanized steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners. ClarkDietrich Mini-Bead 800/900, or equal.
 - b. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening. Use where indicated and at locations required per ASTM C-840. ClarkDietrich #093, or equal.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges. ClarkDietrich #200-A, or equal.
- C. Recessed Picture Rail:
 - 1. Manufacturers:
 - a. Fry Reglet Corp. Reveal Picture Hanger with DRMH clips.
 - b. Pittcon Softforms SWR-050-HT Hanging Track with hanger clips.
 - c. Gordon Final Forms I 926-HT-12 with 926 HCC hanger clips
 - d. Approved equal.
 - 2. Material: Extruded aluminum alloy 6063 T5, with chemical conversion coating.
 - 3. Provide with 1 hanger clip per 24" of rail length, minimum of 4 clips per rail.

2.9 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- 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 and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Shower/Locker Applications:
 - 1. Exterior Gypsum Soffit Board: Use setting-type taping and setting-type, sandable topping compounds.
 - 2. Glass-Mat Gypsum Sheathing Board: As recommended by manufacturer.
- E. Joint Compound for Tile Backing Panels:
 - 1. Water-Resistant Gypsum Backing Board: Use setting-type taping and setting-type, sandable topping compounds.

2.10 ACOUSTICAL MATERIALS

- A. Acoustical Sealant:
 - 1. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant, complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90. Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pecora Corp.; AC-20 Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 - c. Approved equal.
- B. Foam Acoustical Pad:
 - 1. Compressible Filler: Premolded, closed-cell neoprene foam filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; 1/4 inch (6.4 mm) thick, in width to suit steel stud size.

2.11 GLASS-FIBER BLANKET INSULATION

- 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. Knauf Insulation; EcoBatt QuietTherm Insulation
 - 2. CertainTeed Corp; CertaPRO AcoustaTherm Batts.
 - 3. Owens Corning, Ecotouch Unfaced Batt Insulation.
- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- C. Thickness: As indicated on the Drawings. Indicated thicknesses are minimum required.

- D. Locations: Typical interior partitions, and where indicated.
- E. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
 - 1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.
 - 2. Recycled Content: Provide insulation with a minimum of 35% recycled content.

2.12 MINERAL-WOOL BLANKET INSULATION

- 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. Roxul Inc., AFB
 - 2. Thermafiber, SAFB.
 - 3. Johns Manville, equal.
 - 4. Approved equal.
- B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of slag or stone 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.
- C. Low-Emitting Requirement: Product must be certified as low emitting in accordance with either the Scientific Certification System's (SCS's) Indoor Advantage Gold Program or GreenGuard's Children and School's 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 Health Hazard Assessment (OEHHA). See NE-CHPS Guidelines, page 83.
- D. Thickness: As indicated on the Drawings. Indicated thicknesses are minimum required.
- E. Locations: At partitions indicated on the Drawings as Sound Isolation partitions.

2.13 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 (0.84 to 2.84 mm) thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Isolation Strip at Exterior Walls:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.
3. Manufacturers:
 - a. Saint-Gobain Norseal V780
 - b. Gaska Tape, Inc. V800 Series
 - c. Insul-Fab VC Series

2.14 SHAFT WALL CONSTRUCTION

- A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.
- B. Framing Members: Comply with ASTM C 754 for conditions indicated.
 1. Shaft Wall Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
 - a. Profile Types: C-H studs, E studs and other profiles as indicated or required.
 - b. Depth: 2-1/2 inches (64 mm) or 4 inches (102 mm), as indicated.
 - c. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm), or thicker as required to span between floors or other structural supports.
 2. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.
 - a. Minimum Base-Metal Thickness: Matching steel studs.
- C. Gypsum Liner Panels: Comply with ASTM C 442/C 442M and ASTM C 1396 Section 6.
 1. Moisture- and Mold-Resistant Type SLX (shaft liner type X): Manufacturer's standard liner panels with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.
 - a. Core: 1 inch (25.4 mm) thick.
 - b. Long Edges: Double bevel.
 2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. United States Gypsum; Sheetrock Gypsum Liner Panel Mold Tough.
 - b. National Gypsum Co; Gold Bond Fire-Shield Shaftliner XP.
 - c. LaFarge North America, Inc.; Mold-Defense Shaftliner Type X.
- D. Gypsum Board, Accessories and Joint Treatment: As specified in this Section for interior surfaces.
- E. Acoustical Materials: As specified in this Section.

2.15 KNEE BRACES

- A. Provide manufactured knee braces for low height walls equal to Model #SKB as manufactured by Pittcon Softforms LLC, or approved equal.

- B. Material: Fully welded steel assembly consisting of a 2" x 2" steel tube fully welded to a 3-1/2" x 5" x 1/4" steel base plate with (4) 7/16" diameter holes.
 - 1. Steel Tube Wall Thickness: 1/8".
 - 2. Finish: Factory primed.
 - 3. Height: Refer to drawings for wall heights.
 - 4. Anchors: Provide manufacturer's recommended anchors for indicated substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings 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.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
 - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
 - 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
 - a. Use deep-leg deflection track where indicated.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling 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 ceiling suspension system. 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 the location of hangers 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.
 - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 - 4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, 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 support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member and transversely between parallel members.
- C. Sway-brace suspended steel framing with hangers used for support.
- D. For exterior soffits, install cross bracing and framing to resist wind uplift.
- E. Screw furring to wood framing.
- F. Wire-tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.
- G. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
 - 1. Hangers: 48 inches (1219 mm) o.c.
 - 2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
 - 3. Furring Channels (Furring Members): 12 inches (305 mm) o.c.
- H. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum

board assemblies abut other construction.

1. Where studs are installed directly against exterior masonry or dissimilar metal walls, , install foam-gasket isolation strip between studs and wall.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.
 2. For fire-resistance-rated and STC-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
- D. Install steel studs and furring at the following spacings:
 1. Single-Layer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
 2. Multilayer Construction: 16 inches (406 mm) o.c., unless otherwise indicated.
 3. Cementitious Backer Units: 16 inches (406 mm) o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 1. Install two studs at each jamb, unless otherwise indicated.
 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint.
 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. 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.
- H. Knee Braces: Install knee braces in accordance with manufacturer's recommendations.
- I. Z-Furring Members:
 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) 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 (600 mm) 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 (300 mm) from corner and cut insulation to fit.

4. Until gypsum board is installed, hold insulation in place with 10-inch (250-mm) staples fabricated from 0.0625-inch- (1.59-mm-) diameter, tie wire and inserted through slot in web of member.

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- E. 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.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members using resilient channels, or provide control joints to counteract wood shrinkage.
- I. Form control and expansion joints with space between edges of adjoining gypsum panels.
- J. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect open concrete coffer, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffer, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- K. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- L. Floating Construction: Where feasible, including where recommended in writing by manufacturer, install gypsum panels over wood framing, with floating internal corner construction.
- M. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
- N. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications.
- O. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Multilayer Application 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 (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
- C. Multilayer Application 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.
 - 1. 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.
- D. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- E. Multilayer Fastening Methods: Fasten base layers and face layers separately to supports with screws.

- F. 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.
- G. Moisture-Resistant and Glass-Mat Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations. Moisture-Resistant Gypsum Backing Board: Install at where indicated on Drawings. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
 - 2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at locations indicated to receive water-resistant panels.
 - 3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 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. Refer to drawings for additional control joint locations. Custom control joint patterns shall be provided.

3.9 FINISHING GYPSUM BOARD 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 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, according to ASTM C 840, for locations indicated:
 - 1. Level 1: Embed tape at joints in ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies.
 - 2. Level 2: Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where panels are substrate for tile and where indicated.
 - 3. Level 3: Embed tape and apply separate first and fill coats of joint compound to tape, fasteners, and trim flanges where indicated.
 - 4. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

- E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.10 PATCHING GYPSUM WALLBOARD CONSTRUCTION

- A. Patching at Penetrations through Non-Fire-Rated Construction: Patch gypsum wallboard panels to maintain acoustical integrity of partitions, soffits and ceilings. Stuff acoustical insulation around penetrating item, assuring continuity with adjacent insulation. Apply tape and joint compound to cover voids. Finish patched area to match adjacent surfaces. After compound has dried, apply acoustical sealant to fill remaining gaps.
- B. Patching at Penetrations through Fire-Rated Construction: Minimize dimensions of opening around penetrating item using pieces of gypsum wallboard, tape and joint compound. Refer to Section 078400 – FIRESTOPPING, for fire-stopping adjacent to penetrating item.

3.11 INSTALLATION OF CEMENT BOARD FOR EXTERIOR SOFFITS AND SHOWERS/LOCKERS

- A. General: Install cement board in strict accordance with manufacturer's instructions, with rough face exposed for application of thin-set mortar for tile.
- B. Install water barrier where shown on Drawings or otherwise required.
- C. Fasteners shall be spaced no more than 8 inches on center.
- D. Finish: Apply reinforcing mesh, base coat, primer and finish coat as recommended by manufacturer.

3.12 INSTALLATION OF SHAFT WALL ASSEMBLIES

- 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 except comply with framing spacing indicated.
- B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion 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. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch (0.79-mm) minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum board 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, and similar items.
- F. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall 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 ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.
- I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3mm) from the plane formed by faces of adjacent framing.

3.13 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
 - 1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
 - 2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
 - a. Installation of 80 percent of lighting fixtures, powered for operation.
 - b. Installation, insulation, and leak and pressure testing of water piping systems.
 - c. Installation of air-duct systems, air devices and mechanical system control-air tubing.
 - d. Installation of ceiling support framing.

END OF SECTION

SECTION 093000

TILING

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 the following:
 - 1. Ceramic mosaic tile.
 - 2. Glazed wall tile.
 - 3. Porcelain ceramic floor tile.
 - 4. Feature ceramic wall tile.
 - 5. Stone thresholds installed as part of tile installations.
 - 6. Combination waterproof membrane and crack-suppression membrane for tile installations.
 - 7. Metal edge strips installed as part of tile installations.
- B. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Owner Furnished Tiles: Install 410 student wall tiles as furnished by the Owner.
 - 2. Section 083100 – ACCESS DOORS AND FRAMES:
 - a. Access doors in tile assemblies.
 - 3. Section 210001 - FIRE PROTECTION:
 - a. Access doors in tile assemblies.
 - 4. Section 220001 - PLUMBING:
 - a. Access doors in tile assemblies.
 - 5. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Access doors in tile assemblies.
 - 6. Section 260001 - ELECTRICAL WORK:
 - a. Access doors in tile assemblies.
- C. Related Sections include the following:
 - 1. Monolithic slab finishes for tile substrates: Section 033000 – CAST-IN-PLACE CONCRETE.
 - 2. Waterproofing, except as specified herein: Section 070001 – WATERPROOFING,

DAMPPROOFING AND CAULKING

3. Tile-backer board for installation behind wall tile: Section 092900 – GYPSUM BOARD ASSEMBLIES.
4. Toilet accessories to be installed in locations with ceramic tile floor and wall finishes: Section 102800 – TOILET ACCESSORIES.
5. Plumbing fixtures and floor drains to be installed in locations with ceramic tile floor and wall finishes: Section 220000-PLUMBING.
6. Electrical devices in walls: Section 260000 – ELECTRICAL.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 INDOOR AIR QUALITY REQUIREMENTS

- A. Volatile Organic Compounds: All products specified in this section shall comply with the following limits on content of VOC's:
 1. Sealant: Maximum 250 grams/liter total VOC's
- B. No sealant specified in this section for interior installation shall contain aromatic solvents (organic solvent with a benzene ring in its molecular structure), fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium or hexavalent chromium.

1.5 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 1. Level Surfaces in Bathrooms: Minimum 0.8, dry; minimum 0.7, wet.
 2. Level Surfaces in other Locations (as applicable): Minimum 0.6.

1.6 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 1. Full-size units of each type and composition of tile and for each color and finish required.
 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square minimum, but not less than required to show full pattern, and mounted on rigid panel. Use grout of type and in color or

colors approved for completed work.

3. Full-size units of each type of trim and accessory for each color and finish required.
 4. Stone thresholds in 6-inch (150-mm) lengths.
 5. Metal edge strips in 6-inch (150-mm) lengths.
- E. IAQ Submittals: For each product that contains VOC's, comply with submittal requirements specified in Section 018119 – Indoor Air Quality Requirements.
- F. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- G. Product Certificates: For each type of product, signed by product manufacturer.
- H. Qualification Data: For Installer.
- I. Material Test Reports: For each tile-setting and grouting product.

1.7 QUALITY ASSURANCE

- A. Pre-installation Conference: Conduct a pre-installation conference to review tile patterns and specific installation methods.
- B. Source Limitations for Tile: Obtain all tile of same type 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.
- C. 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.
- D. 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. Stone thresholds.
 2. Waterproofing.
 3. Joint sealants.
 4. Metal edge strips.

1.8 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 fluid-applied materials in unopened containers and protected from freezing.
- D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces

of tile, remove coating from bonding surfaces before setting tile.

1.9 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.

1.10 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. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers:
 - 1. Glazed & Unglazed Ceramic Tile:
 - a. Daltile; Div. of Dal-Tile International Inc.
 - b. H&R Johnson Ceramics
 - c. United States Ceramic Tiles
 - 2. Porcelain Ceramic Floor Tile:
 - a. Marca Corona 1741 Evoluzione Ceramica
 - b. Emilceramica
 - c. Roca Tile Group
 - 3. Tile Setting Products:
 - a. Custom Building Products.
 - b. LATICRETE International Inc.
 - c. MAPEI Corporation
- B. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Basis-of-Design Product: The design for each tile type 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 PRODUCTS, GENERAL

- A. Recycled Content: Provide tile products with a minimum of 45 percent total recycled content.
- B. 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.
- C. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- D. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
1. As selected by Architect from manufacturer's full range, or from limited range if specified.
- E. 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.
- F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.
- G. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

- A. Unglazed Ceramic Mosaic Floor Tile (for toilet rooms and showers): Factory-mounted flat tile as follows:
1. Composition: Porcelain.
 2. Surface: Slip-resistant, with abrasive admixture.
 3. Module Size: 2 by 2 inches (50.8 by 50.8 mm).
 4. Nominal Thickness: 1/4 inch (6.35 mm).
 5. Face: Plain with cushion edges.
 6. Basis-of-Design Product: Dal-Tile Corporation, *Keystone Unglazed Mosaic Tile*, or equal by approved manufacturer.
 7. 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 5 different colored tiles in each room from full range in Dal Tile price groups 1 through 4, or equal. Pattern to include 25% in each group.
- B. Glazed Wall Tile (for toilet rooms and showers) as follows:
1. Module Size: 4.25 by 4.25 inches.
 2. Thickness: 1/4 inch (6 mm).
 3. Face: Plain with cushion edges.

4. Finish: Semi-gloss/bright or matte, opaque glaze.
 5. Basis-of-Design Product: Dal-Tile Corporation, or equal by approved manufacturer.
 6. Color/ Pattern: A multi-colored custom random pattern shall be provided as selected by Architect from full range of solid colors utilizing up to 5 different colored tiles in each room from full range in price groups 1 through 3, or equal. Pattern to include 80% group 1 & 2 and 20% group 3.
- C. Feature Ceramic Wall Tile (for corridors, stairs, cafeteria, and lobby) and where indicated as follows:
1. Basis of Design: Dal-Tile Corporation, or equal by approved manufacturer.
 2. Module Size: 4.25 by 4.25 inches.
 3. Thickness: 1/4 inch (6 mm).
 4. Finish: Semi-gloss/bright or matte, opaque glaze.
 5. Color/ Pattern: A multi-colored custom random pattern shall be provided as selected by Architect from full range of colors utilizing up to 8 different colored tiles in each room, area, and color zone; 25 percent from each price group 1 through 4.
- D. Porcelain Ceramic Floor Tile, Treads, and Risers at Kitchen, Stairs, and where indicated as follows:
1. Manufacturer: Elilcermaica
 - a. Model: Backs Provenza
 - b. Tile Size: 8 x 8 inches
 - c. Finish: Glazed
 - d. Color/ Pattern: Solid color-Running bond pattern as shown on the drawings; colors to be selected by the Architect from manufacturers full range.
 2. Manufacturer: Marca Cornona 1741 Evoluzione Caramica
 - a. Model: Eco living
 - b. Tile Size: 8 x 8 inches
 - c. Finish: Glazed
 - d. Color/ Pattern: Solid color-Running bond pattern as shown on the drawings; colors to be selected by the Architect from manufacturer's full range.
 3. Manufacturer: Roca Tile Group
 - a. Model: Rock & Rock Packstone
 - b. Tile Size: 8 x 8 inches
 - c. Finish: Glazed / Striated
 - d. Color/ Pattern: Solid color- Running bond pattern as shown on the drawings; colors to be selected by the Architect from manufacturer's full range.
- E. Typical Transition Material: Provide metal trim as specified herein below.
- F. 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: Straight, module size to match adjacent tile.
 2. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose, module size to match adjacent tile.
 3. External Corners for Thin-Set Mortar Installations: Surface bullnose.
 4. Internal Corners: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.

- G. Ceramic Mosaic 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 Cap: Surface bullnose, module size 2 by 2 inches (50.8 by 50.8 mm).
2. External Corners: Surface bullnose, module size 2 by 2 inches (50.8 by 50.8 mm).
3. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.

- B. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained, matching Architect's sample.

2.5 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANES FOR THIN-SET TILE INSTALLATIONS

- A. General: Manufacturer's standard product that complies with ANSI A118.10.

- B. Fabric-Reinforced, Fluid-Applied Product: System consisting of liquid-latex rubber, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), and fabric reinforcement.

1. Available Products:
 - a. Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane.
 - b. LATICRETE International Inc.; Laticrete HydroBan Waterproof Membrane.
 - c. MAPEI Corporation; Mapelastic AquaDefense.

2.6 SETTING AND GROUTING MATERIALS

- A. Available Manufacturers:

1. Custom Building Products
2. LATICRETE International Inc.
3. MAPEI Corporation.

- B. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:

1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheet-

- ing, ASTM D 4397, 4.0 mils (0.1 mm) thick.
 - 2. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.
 - 3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
 - 4. Product: Laticrete 3701 Latex, or approved equal.
- C. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.
- 1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1.
 - 2. Product: Laticrete 255 Multimax, or approved equal.
- D. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
- 1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 - 2. Prepackaged dry-mortar mix combined with liquid-latex additive.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4.
 - 3. Product: Laticrete 254 Platinum, or approved equal.
- E. Medium-Bed, Latex-Portland Cement Mortar: Provide materials composed as follows, with physical properties equaling or exceeding those required for thin-set mortars based on testing of medium-bed specimens according to ANSI A118.4:
- 1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 - 2. Prepackaged dry-mortar mix combined with liquid-latex additive.
 - 3. Product: Laticrete 220 Medium Bed Mortar with 333 Superflex, or approved equal.
- F. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- G. Standard Sanded Cement Grout: ANSI A118.6, color as indicated.
- 1. Product: Laticrete Permacolor, or approved equal.
- H. Standard Unsanded Cement Grout: ANSI A118.6, color as indicated.
- 1. Product: Laticrete Permacolor, or approved equal.
- I. Polymer-Modified Tile Grout: ANSI A118.7, color as indicated.
- 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 (3.2 mm) and narrower.
 - b. Sanded grout mixture for joints 1/8 inch (3.2 mm) and wider.
- J. Epoxy Grout: ANSI 118.3, color as selected by Architect, at all toilet room, Kitchen, and food prep floors.
- 1. Product: Laticrete Spectralock 2000 IG, Non-Pigmented Epoxy Grout, or approved equal.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
 - 1. Product: Laticrete 3701 Fortified Mortarbed, or approved equal.
- B. Metal Edge and Corner Strips: L-shape, height to match tile and setting-bed thickness, designed specifically for flooring and wall applications; ASTM A 666, brushed stainless steel type 304, exposed-edge material.
 - 1. Basis of Design: Schluter Systems, or approved equal.
 - a. Wall edge and corner units: QUADDEC – 1/4" by Schluter or approved equal.
 - b. Flooring conditions: Manufacturer's standard trim units.
 - c. Receiving area: Schluter ECK-E, or approved equal.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
 - 1. Product: Miralle Sealants, Miralle #1, or approved equal.
- D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.
 - 1. Product: Miralle Sealants, 511 Impregnator, or approved equal.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of 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. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. 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.
- D. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

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. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA 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 floor, 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.
 - 2. Provide multi-color custom random patterns as directed by Architect.
 - F. Lay out tile wainscots to dimensions indicated.
 - G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated or required in accordance with TCA standards during installation of setting materials, mortar beds, and tile. Do not saw-cut joints at new tile work areas after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates and in accordance with TCA recommendations for expansion joints.
 - 2. Provide joint sealant for all control and expansion joints in tile work, and for isolation joints between tile work and adjacent construction.
 - a. Material for vertical application: Multicomponent, Nonsag, Urethane Joint Sealant, ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
 - b. Material for horizontal application: Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25, for Use T.
 - c. Color: Match adjacent grout joints.
 - 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.
- 3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION
- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
 - B. Install fabric reinforcing in coves, corners, cracks, drains, transitions, and where recommended by manufacturer.
 - C. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
 - D. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.
- 3.5 FLOOR TILE INSTALLATION
- A. General: Install tile to comply with requirements in TCA installation methods and ANSI A108 Series of tile installation standards.
 - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
 - a. Tile floors in wet areas.
 - b. Tile floors composed of rib-backed tiles.
 - B. Joint Widths: Install tile on floors with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).

- C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
 - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- D. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, AFC-1, or other flooring that finishes flush with top of tile.
- E. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
 - 1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm), unless noted otherwise.
 - 2. Glazed Wall Tile: 1/16 inch (1.6 mm), unless noted otherwise.
 - 3. Glazed Feature Wall Tile: 1/16 inch (1.6 mm), unless noted otherwise.

3.7 TESTING

- A. Perform a 24-hour flood test for each tile floor area, witnessed by Contractor/Construction Manager and Owner representative. Install and remove temporary dams and drain plugs required to contain water within the space. Immediately correct conditions that do not pass flood test.

3.8 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 latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. 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 and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

SECTION 095100

ACOUSTICAL PANEL CEILINGS

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 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. Items To Be Installed Only: Install the following items as furnished by the designated Sections:
 - 1. Section 210001 - FIRE PROTECTION:
 - a. Access doors in acoustical tile.
 - 2. Section 220001 - PLUMBING:
 - a. Access doors in acoustical tile.
 - 3. Section 230001 - HEATING, VENTILATING, AND AIR CONDITIONING:
 - a. Access doors in acoustical tile.
 - 4. Section 260001 - ELECTRICAL WORK:
 - a. Access doors in acoustical tile.
- C. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 092900 - 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 WORK for light fixture and alarm system components located in ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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.
- C. 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.
- D. 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.
- E. 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. Recycled Content: Minimum 70 percent pre-consumer recycled content.
- B. Products: Subject to compliance with specified requirements, provide one of the following products or approved equal for each type indicated.
- C. Basis of Design Ceiling Types:
 - 1. C1A – 2 x 4 staggered lay in Rockfon Alaska
 - 2. C1B – 2x4 lay in grid lay in Rockfon Alaska
 - 3. C1C – 2x2 lay in grid Rockfon Alaska
 - 4. C1D – 2x8 lay in Rockfon Sonar
 - 5. C1E – 2x4 lay in Rockfon Pacific
 - 6. C4A – 2 x 4 lay in Rockfon Alaska dB
 - 7. C6A – 2X4 lay in Rockfon Medical Plus

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, or Chicago Metallic.
 2. Structural Classification: Intermediate-duty system.
 3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
 4. Face Design: Profiled, stepped flange or flat, flush flange as indicated.
 5. Cap Material: Steel or aluminum cold-rolled sheet.
 6. Color: White, prefinished, unless noted otherwise.
 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.

2.3 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed Sheet-Metal Edge Moldings: 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/ shadow edge molding 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.
- B. Perimeter Trim: For ceiling edge in the music platform/rolling curtain edge, and where indicated on the drawings, use Armstrong Axiom (2-1/8") or USG Compasso (2-1/4") metal

trim; or approved equal. Commercial quality cold-rolled steel, factory finished in color to be selected by Architect.

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. See perimeter size requirements as specified in Part 2.
- B. Refer to Part 2 Products for requirements of ceiling panels at perimeter of room.

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 ADDITIONAL MATERIALS, CLEANING AND REPLACEMENT
- A. After completion of this work, deliver to the Owner's maintenance representative one complete box of each type of tile and panel taken from the same mill run as units used on the Project.
 - B. Properly clean, or replace, as directed by the Architect, all damaged and soiled tile and panels at no additional cost to the Owner.
 - C. Remove all cartons, containers, rubbish and waste materials from the premises as they accumulate, and on completion, remove all surplus materials from the building.

END OF SECTION

SECTION 096400

STAGE 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. Stage flooring assemblies.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 033000 - CAST-IN-PLACE CONCRETE for substrate.
 - 2. Section 099000 – PAINTING AND COATING for painting hardboard wood flooring.

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.
- C. Qualification Data: For Installer.
- D. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.

1.4 SUSTAINABLE MATERIALS 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. .

- E. 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 standard.
 1. 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.
- F. 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.

1.4 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 installer with a minimum of 5 years of experience 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.
 2. Single installer for entire system.
- C. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut. Each bundle shall bear MFMA certification marking.
- D. Mock-ups: Before beginning primary work of this Section, provide a 10 ft. x 10 ft. mock-up at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this Section to serve as criteria for acceptance of this work. Acceptable mock-ups may be included as part of the finished work.
 1. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area.

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, and in horizontal position.

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.

1.7 WARRANTY

- A. Provide manufacturer's standard 1 year warranty.

1.8 MAINTENANCE CONTRACT

- A. Three-Year Maintenance Contract: As part of the Work of this Section, installer shall provide three-year Contract to inspect and maintain flooring system installed. Maintenance Contract shall include materials and labor to perform the following on an annual basis, beginning with one year after Substantial Completion:
 - 1. Evaluate condition of flooring system.
 - 2. Strip and refinish flooring using specified finishes, according to manufacturer's recommendation.
 - 3. Advise and train Owner's staff regarding maintenance procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers whose products may be incorporated into the Work include, the following:

1. Aacer Sports Flooring.
2. Action Floor Systems.
3. Horner Flooring Company, Inc.
4. Robbins Sports Surfaces, Inc.
5. Or equal

2.2 STAGE WOOD FLOORING

A. Flooring system:

1. 1/4" Masonite in opposite direction of bottom layer.
2. 3/4" CDX Plywood placed on 45 degree angle.
3. 3/4" CDX Plywood.
4. Eclipse Resilient Pad by Robbins, or approved equal – 7/16" Resilient Pad.
5. Vapor Barrier – 15 mil polyethylene.

2.3 ACCESSORY MATERIALS

A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 15 mils thick.

1. If the moisture content is 80% RH or higher, comply with manufacturer requirements for required thickness/perm rating.
2. Perm Rating: .04 perm, maximum.

B. Vented Cove Base [VCB]: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches (100 by 75 by 1200 mm); with premolded outside corners.

1. Color: As selected by Architect from manufacturers full range.

C. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.

D. Metal Saddle: Extruded aluminum saddle threshold, 1/4 inch (6 mm) high, width as shown on Drawings, length equal to width of door opening.

1. Acceptable Manufacturers:
 - a. Pemko
 - b. National Guard Products
 - c. Zero International
 - d. Or Equal
2. Finish: Mill finish aluminum.
3. Provide solid threshold without factory-drilled holes.
4. Product: Pemko, Saddle Threshold 270 Series, or equal by approved manufacturer.

E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.

F. 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).

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 concrete slab complies with tolerances and other requirements specified in Section 033000 – CAST-IN-PLACE CONCRETE.
 2. 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.
- D. Alkalinity and Adhesion Testing:
 1. 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.
- E. 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.
 1. Perform additional tests recommended by manufacturer.
 2. 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. Spacing shall be uniform and linear.
- 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. Installation Tolerances: 1/8 inch in 10 feet of variance from level.

3.4 PROTECTION

- A. Protect 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.
 - 1. Do not cover 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 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 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, school logo, and line work as indicated.
- B. Installation Only:
 - 1. Install volleyball inserts, furnished by Section 116620 – ATHLETIC EQUIPMENT.
- C. Related Work: The following items are not included in this Section and will be performed 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, school logo, and markers.
 - 3. Locations of floor inserts for athletic equipment installed through flooring assembly.
- C. Samples for Initial Selection: Floor finish and game line and marker paint.
- D. 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.
3. Sample shall include entire sports floor assembly, including: resilient pads, plywood, and finish flooring.

E. Qualification Data: For Installer.

F. Maintenance Data: For wood sports-floor assemblies and finish systems to include in maintenance manuals.

1.4 SUSTAINABLE MATERIALS 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. .

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 standard.

1. 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.

1.4 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 installer with a minimum of 5 years of experience 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.

2. Single installer for entire system.

C. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut. Each bundle shall bear MFMA certification marking.

D. Mock-ups: Before beginning primary work of this Section, provide a 10 ft. x 10 ft. mock-up at locations acceptable to Architect and obtain Architect's acceptance of visual qualities. Protect and maintain acceptable mock-ups throughout the work of this Section to serve as criteria for acceptance of this work. Acceptable mock-ups may be included as part of the finished work.

1. To set quality standards for sanding and application of field finishes, prepare finish mockup of floor area.

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, and in horizontal position.

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.

1.7 WARRANTY

A. Provide manufacturer's standard 1 year warranty.

1.8 MAINTENANCE CONTRACT

- A. Three-Year Maintenance Contract: As part of the Work of this Section, installer shall provide three-year Contract to inspect and maintain flooring system installed. Maintenance Contract shall include materials and labor to perform the following on an annual basis, beginning with one year after Substantial Completion:
1. Evaluate condition of flooring system.
 2. Strip and refinish flooring using specified finishes, according to manufacturer's recommendation.
 3. Advise and train Owner's staff regarding maintenance procedures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers whose products may be incorporated into the Work include, the following:
1. Aacer Sports Flooring.
 2. Action Floor Systems.
 3. Horner Flooring Company, Inc.
 4. Robbins Sports Surfaces, Inc.
 5. Or equal

2.2 WOOD FLOORING SYSTEM

- A. Wood Athletic Flooring Type: Anchored resilient flooring designed for heavy loads.
- B. System Description: Provide complete resilient wood floor system comprising the following:
1. Maple finished floor.
 2. Load-distributing plywood subfloor.
 3. Plywood sleeper assembly.
 4. EPDM resilient pads.
 5. Polyethylene vapor retarder, vented base, metal saddles and accessories as required for complete installation.
- C. Total System Thickness: 2-5/8 inch (67 mm).
- D. Basis of Design: Drawings and specifications are based on the following system, to establish the general character and materials required for athletic wood flooring for this project. Equivalent products by acceptable manufacturers will be approved.
1. Robbins Sports Surfaces, Inc.; *MACH-I HL*.

2.3 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.
 - a. Exception: For areas under stacked portion of telescoping bleachers that are normally concealed from view, provide Third and Better Grade.
 - 2. Thickness: 25/32 inch (20 mm).
 - 3. Face Width: 2-1/4 inches (57 mm).
 - 4. Backs: Channeled (kerfed) for stress relief.

2.4 SUBFLOOR SYSTEM

- A. Plywood Sleeper Assembly: APA rated plywood subfloor, C-D Plugged, exterior glue, tongue and groove, 15/32 inch (12 mm) thick.
 - 1. Sleeper Shims: In size and type recommended in writing by flooring manufacturer for application indicated.
- B. Resilient Pads: With air voids for resiliency and installed at manufacturer's standard spacing for product designation indicated above.
 - 1. Type: Resilient shock pads designed for longevity, stability and performance.
 - 2. Material: Ethylene-propylene-diene terpolymer (EPDM). Vinyl pads will not be approved.
 - 3. Thickness: 7/16 inch (11 mm).

2.5 ACCESSORY MATERIALS

- A. Vapor Retarder: ASTM D 4397, polyethylene sheet not less than 8.0 mils thick.
 - 1. If the moisture content is 85% RH or higher, comply with manufacturer requirements for required thickness/perm rating.
- B. Vented Cove Base [VCB]: Molded, vented, rubber or vinyl cove base; 4 by 3 by 48 inches (100 by 75 by 1200 mm); with premolded outside corners.
 - 1. Color: Black.
- C. Fasteners: Type and size recommended by manufacturer, but not less than those recommended by MFMA for application indicated.
- D. Metal Saddle: Extruded aluminum saddle threshold, 1/4 inch (6 mm) high, width as shown on Drawings, length equal to width of door opening.
 - 1. Acceptable Manufacturers:
 - a. Pemko
 - b. National Guard Products
 - c. Zero International
 - d. Or Equal

2. Finish: Mill finish aluminum.
 3. Provide solid threshold without factory-drilled holes.
 4. Product: Pemko, Saddle Threshold 270 Series, or equal by approved manufacturer.
- E. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by sports-floor manufacturer.
- F. 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).
- G. Cover Plates: Provide rectangular wood cover plates with brass trim. Wood shall match gymnasium flooring and shall be cut from manufacturer's provided template.
1. Size: 8-5/8 inches x 13-3/8 inches.
 2. Location: Three scorer's table locations, to be selected by Architect.
- H. 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.

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 concrete slab complies with tolerances and other requirements specified in Section 033000 – CAST-IN-PLACE CONCRETE.
 2. 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.
- D. Alkalinity and Adhesion Testing:
 - 1. 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.
- E. 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.
 - 1. Perform additional tests recommended by manufacturer.
 - 2. 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. Subfloor System:

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, and as required to meet specified performance requirements.
3. Anchor predrilled sleepers through resilient pads.

F. Strip Flooring: Mechanically fasten perpendicular to supports.

G. 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, School Logo, and Markers: Apply game-line, school logo, 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.
 - e. Coordinate school logo requirements with Owner and Architect and provide stenciling and painting of school logo.

3.5 INSTALLATION OF EQUIPMENT INSERT ASSEMBLIES

A. General: Installation of equipment insert plates and anchor assemblies shall be in accordance with equipment manufacturer's insert specifications.

1. Install volleyball floor inserts furnished under Section 116620 – ATHLETIC EQUIPMENT, and coordinate installation with the work of that section.

- B. Install equipment insert plates and insert plate anchor assemblies where required in locations shown on Drawings. Boards shall be cut to fit tightly around insert pallets. Inserts shall be positioned and anchored to the slab as indicated on approved Shop Drawings.
- C. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

3.6 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.
 - 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 096500
RESILIENT 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. Linoleum tile.
 - 2. Sheet linoleum.
 - 3. Sheet rubber.
 - 4. Resilient wall base and accessories, including accessories for resilient flooring and carpet.
 - 5. Rubber stair accessories.
 - 6. Substrate preparation for resilient flooring and accessories.
 - 7. Rubber floor tile in elevator.
 - 8. Metal edge strips.
- B. Alternates: Refer to Drawings and Section 012300 - ALTERNATES for requirements.
- C. Related Sections include the following:
 - 1. Section 033000 – CAST-IN-PLACE CONCRETE, for preparation and drying of concrete prior to installation of resilient flooring.
 - 2. Section 090160 - VAPOR MITIGATION AT SLABS, for mitigation system below carpet.
 - 3. Section 096820 – CARPETING, for carpet.
 - 4. Section 123000 – MANUFACTURED CASEWORK, for base cabinets to which resilient base will be applied.
 - 5. Section 142400 – HYDRAULIC ELEVATORS, for elevator cab subfloor to which resilient flooring and resilient base will be applied.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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.
- C. Samples for Verification: Full-size units of each color and pattern of resilient flooring 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.
 3. Rubber stair accessories.
- D. 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.
- E. Maintenance Data: For resilient products to include in maintenance manuals.
- F. Test Reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
1. Engage an installer who employs workers for this Project who are trained or certified by resilient flooring manufacturer for installation techniques required.
- B. Patterns: Scope of work for this project requires intricate custom random patterns within resilient flooring. Provide waterjetting to achieve required designs.
- C. 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.
- D. 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.

1.5 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.

1.7 WARRANTY

- A. Provide manufacturer's standard warranty for all products specified, unless indicated otherwise.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.
 - 2. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 LINOLEUM TILE FLOORING

- A. Rapidly Renewable Material: Provide linoleum flooring consisting of a minimum of 25 percent rapidly renewable raw material.
- B. Durable and Low Maintenance Flooring: Provide linoleum flooring that is impermeable to moisture and air.
- C. Warranty: Provide linoleum flooring with a 15 year, non-prorated lifetime warranty.
- D. Manufacturers:
 - 1. Armstrong World Industries, Inc.
 - 2. Forbo Industries.
 - 3. Tarkett Inc.
- E. Linoleum Tile Flooring: Solidified mixture of linoleum cement binder and ground cork, wood flour, mineral fillers, and pigments bonded to a fibrous or other suitable backing so that backing is partially embedded in mixture. Patterns and colors extending through entire wear-layer thickness. Provide linoleum tile in color and pattern selected by the Architect and as follows:
 - 1. Basis of Design: Marmoleum MCT as manufactured by Forbo Industries, or approved equal.
- F. Thickness: 2.0 mm.
- G. Colors: As selected by Architect from manufacturer's full range.
 - 1. Patterns: Provide up to five colors per room, in proportions as required to produce cus-

tom, random, and curvilinear patterns from artwork to be supplied by Architect.

2.2 LINOLEUM SHEET FLOOR COVERING

- A. Rapidly Renewable Material: Provide linoleum flooring consisting of a minimum of 25 percent rapidly renewable raw material.
- B. Durable and Low Maintenance Flooring: Provide linoleum flooring that is impermeable to moisture and air.
- C. Warranty: Provide linoleum flooring with a 15 year, non-prorated lifetime warranty.
- D. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.
 - 1. Forbo Flooring, Inc.
 - 2. Tarkett Inc.
 - 3. Approved equal.
- E. Basis of Design: Provide Marmoleum Real as manufactured by Forbo Flooring, Inc.
- F. Thickness: 2.0 mm.
- G. Sheet Width: 78 inches.
- H. Seaming Method: Welded.
- I. Colors: As selected by Architect from manufacturer's full range.
 - 1. Patterns: Provide up to five colors per room, in proportions as required to produce custom, random, and curvilinear patterns from artwork to be supplied by Architect.

2.3 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 selected by Architect from manufacturers full range.
- C. Thickness: 2.5 mm to match adjacent linoleum flooring.
- D. Wearing Surface: Smooth.
- E. Sheet Width: As standard with manufacturer.
- F. Seaming Method: Standard.

2.4 RUBBER FLOOR TILE FOR ELEVATOR

- A. Rubber Floor Tile: ASTM F 1344.
 - 1. Endura
 - 2. Johnsonite
 - 3. Mondo Rubber International, Inc.
 - 4. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
 - 5. Roppe Corporation.
- B. Style and Colors: As selected by Architect.
- C. Thickness: 0.125 inch.
- D. Size: 24 by 24 inches nominal.

2.5 RUBBER STAIR TREADS AND RISERS [RBRF]

- A. Treads: FS RR-T-650.
 - 1. Johnsonite
 - 2. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
 - 3. Mannington Mills.
- B. Basis of Design: Specifications are based on the following product. Equal products by approved manufacturers will be accepted if they meet all the requirements of this section and conform to the detailed requirements of the Drawings.
 - 1. Nora Rubber Flooring, Freudenberg Building Systems, Inc., *Norament 925 Grano Stair-treads*.
- C. Material: Rubber, Composition A.
- D. Rubber Stair Treads with Integral Risers: Molded rubber tread and riser, furnished in one piece for full coverage of each tread and riser.
- E. Surface Design: Hammered.
 - 1. 1910 Hammered texture.
- F. Nosing Style: Angled.
- G. Dimensions:
 - 1. Nosing Height: 1-3/4 inches.
 - 2. Thickness:
 - a. Tread: Nominal 0.25 inch (6 mm), tapering to 0.1875 inch (5 mm) at butt edge.
 - b. Riser: Nominal 0.25 inch (6 mm).
 - 3. Size: Lengths and depths to fit each stair tread in one piece.
- H. Provide visually impaired strips for top and bottom steps for each floor level, color to be selected by Architect.
- I. Fire-Test-Response Characteristics:
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.6 RESILIENT BASE [RB]

- A. Rubber Wall Base: Provide rubber wall base by Johnsonite, Flexco, Mannington Mills, or approved equal conforming to ASTM F 1861, Group 1, Type TP, and as follows:
 - 1. Height: 4 in. typical.
 - 2. Thickness: 1/8 in. gage.
 - 3. Style: Top-set cove at resilient flooring Style B (Cove), straight at carpet Style A (Straight). Provide formed corners.
 - 4. Finish: Matte.
 - 5. Roll Lengths: 100 ft. rolls, continuous runs with no pieces less than 10 ft. in any run over 100 ft.
 - 6. Adhesive: Parabond adhesive and cement.
 - 7. Colors: As selected by Architect.
 - 8. Corners: Premolded for outside corners. Field form inside corners.

2.7 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, expansion joint seal transition for wood flooring, reducer strip for resilient floor covering, joiner for tile and carpet
 - 1. Johnsonite
 - 2. American Biltrite.
- B. Material: Rubber.
- C. Profile and Dimensions: As indicated.

2.8 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 slab surfaces to receive resilient flooring.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT and Asphalt Tile Adhesives: 50 g/L.
 - b. Cove Base Adhesives: 50 g/L.
 - c. Rubber Floor Adhesives: 60 g/L.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
- D. 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. Provide where indicated.

1. Transitions between resilient flooring and walk-off mats, and other locations indicated on drawings.
 - a. Basis of Design: Provide Schluter RENO-V, or approved equal.
- E. Seamless-Installation Accessories:
 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: Match adjacent floor covering.
 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

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.
- G. Rubber Flooring: Installer shall remove paraffin from rubber flooring in accordance with manufacturer's written instructions.

3.3 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 by Architect.
- 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.
- H. Provide tile inserts in plumbing clean out covers and other mechanical floor access.

3.4 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. Cut sheets using waterjetting for intricate patterns.
 - J. 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.
 - K. 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.
- 3.5 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 4 coats of protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes as recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to manufacturer.
 - b. Coordinate selection of floor polish with 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, poured type.
 - 2. Sports surface flooring, interlocking tile type.
 - 3. Substrate preparation for resilient flooring and accessories.
- 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. 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. Shop Drawings: Submit plans of each area receiving synthetic sports surfacing. Show locations of inserts and layout of game lines and markings, where required.
- C. 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.
- D. Literature: Submit manufacturer's technical data on characteristics, performance and maintenance of all products.
- E. IAQ Submittals: For each product that contains VOC's, comply with submittal requirements specified in Section 018119 – Indoor Air Quality Requirements.
- F. 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. Advantage Sport USA, 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 STRENGTH TRAINING 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: Robbins Flooring, *Pulastic Classic 110*, or equal by approved manufacturer.
- B. Three-layer construction:
 - 1. Shock pad:
 - 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:
 - 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 cus-

tom, 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 096820
CARPETING

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 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. Tufted carpet.
 - 2. Substrate preparation for carpet flooring and accessories.

1.3 RELATED WORK

- A. Section 064020 – INTERIOR ARCHITECTURAL WOODWORK for wood trim adjacent to carpeted platforms.
- B. Section 096500 – RESILIENT FLOORING for transition strips, wall base and other resilient accessories.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation methods.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet type, color, and dye lot.
 - 3. Seam locations, types, and methods.
 - 4. Type of subfloor.
 - 5. Type of installation.
 - 6. Pattern of installation.
 - 7. Pattern type, location, and direction.
 - 8. Pile direction.
 - 9. Type, color, and location of insets and borders.

- 10. Type, color, and location of edge, transition, and other accessory strips.
- 11. Transition details to other flooring materials.

- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Tufted Carpet: 12-inch- (300-mm-) square Sample.
 - 2. Carpet Seam: 6-inch (150-mm) Sample.
 - 3. Exposed Edge Stripping and Accessory: 12-inch- (300-mm-) long Samples.
- D. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.
- E. Qualification Data: For Installer.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- G. Maintenance Data: For carpet to include in maintenance manuals. 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.
- H. Warranties: Special warranties specified in this Section.
- I. IAQ Submittals: For each product that contains VOC's, or is otherwise regulated under OSHA Hazard Communication Standard 1610.1200, comply with submittal requirements specified in Section 018119 – Indoor Air Quality Control.

1.5 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. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."
- B. Deliver materials to the site in manufacturer's original packaging, labeled with name of manufacturer and product, identification number and related information.
- C. Store carpet products and installation materials on flat surfaces, in dry spaces protected from

the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 60 deg F (16 deg C) or more than 80 deg F (27 deg C), and relative humidity below 65 percent.

- D. Place carpet materials in area where they will be installed, for a minimum of 48 hours prior to installation.

1.7 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 until building is enclosed, 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.
 - 1. Maintain minimum 65 degrees F (18 deg C) and 65 per cent relative humidity for 72 hours prior to, during and 48 hours after installation.
 - 2. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have the following moisture and pH levels, as recommended by carpet manufacturer.
 - 3. Moisture: Perform anhydrous calcium chloride test, ASTM F 1869, under conditions where building is enclosed and temperature and humidity have been stabilized. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (0.82 kg of water/92.9 sq. m) in 24 hours, or as otherwise required in writing by manufacturer of carpet.
 - 4. Alkalinity: No carpet shall be installed unless pH of substrate measures between 7 and 9.
- C. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

- A. Special Warranty for Carpet: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
 - 3. Warranty Period: 25 years from date of Substantial Completion.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Tufted Carpet: Full-width rolls equal to 5 percent of amount installed for each type indi-

cated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 GENERAL

- A. Recycled Content: Provide carpeting with a minimum of 10 percent post consumer recycled content.

2.2 TUFTED CARPET

- A. Products: Subject to compliance with meeting specified requirements provide products from the following manufacturers or approved equal:

- 1. Tandus Flooring, Inc.
- 2. Milliken & Co.
- 3. Shaw Industries Group, Inc.
- 4. Approved equal.

- B. Basis of Design: Provide Tandus – Circlet 02888; or approved equal.

- C. Fiber Specifications:

- 1. Fiber Content: 100 percent nylon 6, 6
- 2. Fiber Type: Bulk continuous filament.
- 3. Dye Method: solution dyed

- D. Carpet Construction:

- 1. Pile Characteristic: Patterned Loop.
- 2. Density: 7516 oz/cu yd
- 3. Pile Thickness: 0.091 inch for finished carpet.
- 4. Stitches: 9.8 per inch
- 5. Gage: 5/64
- 6. Face Weight: 19 oz./sq. yd.

- E. Backing Materials

- 1. Primary Backing: Manufacturer's standard material.
- 2. Secondary Backing: Closed-cell vinyl cushion backing system in compliance with the following:
 - a. Density: 18.5 lb./cu. ft. per ASTM D 1667
 - b. Compression Set: Maximum 10 percent, per ASTM D 1667
 - c. Compression Deflection: between 7psi and 25 psi at 25 percent, per ASTM D 1667.
 - d. Liquid Water Permeance: No penetration when tested according to the British Spillage Test.

- F. Seams: Carpet/backing system shall be formulated to permit chemical welding of seams, to maintain impermeability of installed carpet with respect to air and liquid water.

- G. Width: 6 feet (1.8 m).
- H. Color and Style: As selected by Architect from manufacturers full range of products that comply with specified requirements.
- I. Performance Characteristics: As follows:
 - 1. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
 - 2. Smoke Density: Not more than 450 Flaming Mode, per ASTM E 662.
 - 3. Dry Breaking Strength: Not less than 100 lbf (445 N) per ASTM D 2646.
 - 4. Tuft Bind: Not less than 10 lbf (45 N) per ASTM D 1335.
 - 5. Delamination: Not less than 5 lbf (22 N) per ASTM D 3936.
 - 6. Noise Reduction Coefficient (NRC): No less than 0.13 per ASTM C 423.
 - 7. Impact Insulation Class (IIC): No less than 54, per ASTM E 492.
 - 8. Colorfastness to Crocking: Not less than 4, wet and dry, per AATCC 165.
 - 9. Colorfastness to Light: Not less than 4 after 100 hours (AATCC fading units) per AATCC 16, Option E.
 - 10. Electrostatic Propensity: Less than 3.0 kV per AATCC 134.
 - 11. Static Coefficient of Friction: Minimum 0.60 per ASTM C 1028.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by carpet tile manufacturer.
- B. Carpet Adhesives: Factory-applied, non-flammable contact adhesive for 100% uniform coverage, as recommended by the carpet manufacturer for each type of surface to which carpet is applied.
 - 1. Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and that is recommended by carpet tile manufacturer.
 - a. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).
 - 2. Provide manufacturer's recommended adhesives designed for use on concrete slabs with relative humidity up to 95 percent. Adhesive shall be compatible with moisture mitigation system.
 - 3. Provide peel-off protective strips.
 - 4. Product: Collins & Aikman Floorcoverings, *RS Tackifier*, or equal by carpet manufacturer.
- C. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and 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, with Installer present, for compliance with re-

quirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.
 - 2. Subfloor finishes comply with requirements specified in notes on Structural Drawings for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 4. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 5. 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.
- C. Proceed with installation only after substrates unsatisfactory conditions have been corrected.
- D. Plywood Substrates: Install carpeting on horizontal and vertical surfaces of stepped risers in Lecture room and where indicated.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and 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, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile. 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:
 - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
- B. 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 tile manufacturer.

- C. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- D. Weld seams using manufacturer's standard chemical seam welding method.
- E. 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.
- F. Install pattern parallel to walls and borders.
- G. Install appropriate transition strip at carpet edges adjacent to other flooring finishes.

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.
 - 4. Vacuum carpet with a high-efficiency particulate arrestor (HEPA) vacuum prior to occupancy.
- B. Protect installed carpet tile to comply with CRI 104, Section 15, "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 098400

ACOUSTIC ROOM COMPONENTS

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. Acoustic wall panels.
- B. 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.
 - 2. Section 092900, GYPSUM BOARD ASSEMBLIES; Drywall substrates to which acoustical panels are applied.
 - 3. Section 095100 - ACOUSTICAL PANEL CEILINGS for acoustical ceiling panels supported by exposed suspension system and tested for noise reduction.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Submit shop drawings of panels indicating panel dimensions, finish, and method of attachment to substrate.
- C. Samples: Submit duplicate specified panel samples in full range of colors for Architect's color selection. Minimum sample size: 8 in. x 8 in.
- D. Certificates: Submit copies of certification of acoustical panel fire hazard classification of fire rating organization.
- E. Maintenance Data: Prepare and submit data for incorporating into the Project Maintenance Manual. Provide recommendations for care and cleaning of panels.

1.4 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.
- C. 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. Installer Qualifications: Use skilled mechanics who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with specified requirements and methods needed for proper installation of work.
- B. Requirements of Regulatory Agencies: Acoustical panels and ceiling reflectors shall comply with local applicable Building Code fire-resistant requirements for interior finish and shall be classified as Class I material.
1. Maximum flame spread: 0-25
 2. Testing: ASTM E 84
- C. Acoustical wall treatment materials shall meet or exceed the fire hazard requirements of authorities having jurisdiction.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in manufacturer's original unopened protective packaging with labels intact and legible identifying manufacturer, brand name, and contents.
- B. Store products in original packaging off ground in a sheltered, dry area.
- C. Handle products in a manner which prevents staining or physical damage.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical 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 panels until a permanent level of lighting is provided on surfaces to receive acoustical wall panels.
- C. Air-Quality Limitations: Protect acoustical 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 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 panels and ceiling reflectors 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 BACK-MOUNTED, EDGE-REINFORCED ACOUSTICAL WALL PANELS WITH GLASS-FIBER BOARD CORE

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ecophon.
 - 2. Armstrong.
 - 3. Soundseal.
 - 4. Approved Equal.
- C. 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.
- D. 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.
- E. Nominal Core Density: 4 to 7 lb/cu. ft..
- F. Facing Material: Painted.

- G. Nominal Core Thickness and Overall System NRC: 1 inch and not less than NRC 0.80, for Type A mounting per ASTM E 795.
- H. Panel Width: As indicated on Drawings
- I. Panel Height: Fabricated height as indicated on Drawings.
- J. Panel Edge Detail: Square.
- K. Corner Detail: Square to form continuous profile to match edge detail.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical panels and ceiling reflectors.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install acoustical 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 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. 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 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical panels are without damage or deterioration at time of Substantial Completion.
- B. Replace acoustical 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 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.

- B. Related Work: The following items are not included in this Section and will be performed 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 055100 - METAL STAIRS for shop priming ferrous metal.
- 4. Section 064020 - INTERIOR ARCHITECTURAL WOODWORK for shop finishing interior architectural woodwork.
- 5. Section 081110 - HOLLOW METAL DOORS AND FRAMES for factory priming steel frames.
- 6. Section 081400 - FLUSH WOOD DOORS for factory finishing.
- 7. Section 083100 - ACCESS DOORS AND FRAMES for factory prime coating for access doors.
- 8. Section 083470 - SOUND CONTROL DOOR ASSEMBLIES for factory priming steel frames.
- 9. Section 092900 - GYPSUM BOARD ASSEMBLIES for surface preparation of gypsum board.
- 10. Section 098400 - ACOUSTIC ROOM COMPONENTS for factory finished acoustic panels.

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. The Architect will furnish a schedule of colors for each area and surface. All colors shall be mixed in accordance with the manufacturer's instructions. The number of coats required to ensure adequate and complete coverage in the opinion of the Architect shall not necessarily be limited to the number of coats specified in the Painting Schedule contained in this Section. More than one color may be used on any wall surface with straight line separation between colors at no additional cost to the Owner. The Architect reserves the right to select at no additional cost, vibrant, bright or accent colors, in a quantity of up to 3 different vibrant colors per classroom and up to 6 different vibrant colors in common spaces. Provide up to twelve (12) different vibrant colors for the entire project.
 - 1. Painting includes field painting of exposed bare and covered pipes, conduits, cables, and ducts, hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
 - 2. Painting includes field painting of factory primed exposed exterior steel lintels and relieving angles.
 - 3. Painting shall include field painting of factory primed metal access panels, including access panels installed within ceramic tile walls.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. 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.
 - 2. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - c. Chromium plate.
 - d. Copper and copper alloys.
 - e. Bronze and brass.
 - f. Titanium zinc alloy.
 - 3. 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.

4. 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. Samples for Verification: For each color and material to be applied.
 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.
- C. 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.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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, 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 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 (HVAC, Plumbing, and Fire Protection) and Electrical Work: Painting of mechanical, plumbing, fire protection, and electrical work is limited to items exposed in and occupied spaces and in Storage Rooms unless otherwise indicated on drawings.
- F. Mechanical, plumbing, and fire protection items to be painted include, but are not limited to, the following:
1. Uninsulated metal piping and ducts.
 2. Uninsulated plastic piping.
 3. Pipe hangers and supports.
 4. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
 5. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
 6. Mechanical equipment that is indicated to have a factory-primed finish for field painting mounted within walls.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Electrical conduit and junction boxes.
 2. Electrical equipment that is indicated to have a factory-primed finish for field painting.
 3. Electrical/data cabling.
- H. Block Fillers: Apply block fillers to concrete masonry units 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.
- M. In addition to requirements as specified herein, paint exposed exterior gas piping; refer to plumbing and Mechanical Drawings. Paint site bollards, refer to Civil, Landscape and electrical Drawings.

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 may 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 EXTERIOR PAINTING SCHEDULE

- A. Ferrous metal, new and galvanized:

1. First coat: Shop-primed under Section 055000 – Metal Fabrications.
2. Two Coats: Chemical-resistant, high performance, acrylic urethane finish coats.
 - a. Ben Moore: WB Urethane Gloss, P73 Series
 - b. Devoe Coatings: Devthane Urethane Gloss, 379H Series
 - c. PPG: Durethane WB Urethane, 98-8200 Series
 - d. S-W: Acrolon 218 Acrylic Aliphatic Urethane Gloss B65-600 Series

3.8 INTERIOR PAINTING SCHEDULE

A. Metals not requiring high performance coatings:

1. First coat: (Non-primed galvanized metal and aluminum items)
 - a. Ben Moore: Super Spec HP Acrylic Metal Primer, P04
 - b. Devoe Coatings: Devflex Primer/Finish, 4020PF
 - c. PPG: Pitt Tech Plus Primer, 90-912 Series
 - d. S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
2. First coat: (New unprimed ferrous metal)
 - a. Ben Moore: Super Spec HP Acrylic Metal Primer, P04
 - b. Devoe Coatings: Devflex Primer/Finish, 4020PF
 - c. PPG: Pitt Tech Plus Primer, 90-912 Series
 - d. S-W: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
3. Two coats: (over primed metal)
 - a. Ben Moore: Super Spec HP DTM Acrylic S/G, P29 Series
 - b. Devoe Coatings: Devflex 4216 HP Acrylic S/G
 - c. PPG: Pitt Tech Plus S/G, 90-1210 Series
 - d. S-W Pro Industrial Zero VOC Semi-Gloss Acrylic, B66-650 Series

B. Gypsum Wallboard, Vertical Surfaces:

1. First coat:
 - a. Ben Moore: Natura Primer, 512
 - b. Glidden Pro: Lifemaster No VOC Primer, 9116
 - c. PPG: Pure Performance Primer, 9-900
 - d. SW: Harmony Primer, B11
2. Two coats:
 - a. Ben Moore: Natura Eggshell, 513 Series
 - b. Glidden Pro: Lifemaster No VOC Eggshell, 9300 Series
 - c. PPG: Pure Performance Eggshell, 9-310 Series
 - d. S-W: Harmony Eggshell, B9 Series

C. Gypsum Wallboard, Overhead Surfaces:

1. First coat:
 - a. As specified above for vertical surfaces.
2. Two Coats:
 - a. Ben Moore: Natura Flat, 512 Series
 - b. Glidden Pro: Lifemaster NO VOC Flat, 9100 Series
 - c. PPG: Pure Performance Flat, 9-110 Series
 - d. SW: Harmony Flat, B5 Series

D. Wood, Opaque Finish (except transparent finish hardwood):

1. First coat:
 - a. Ben Moore: Natura Primer, 512
 - b. Glidden Pro: Lifemaster No VOC Primer, 9116
 - c. PPG: Pure Performance Primer, 9-900
 - d. SW: Harmony Primer, B11
 2. Two coats:
 - a. Ben Moore: Natura Semi-Gloss, 514 Series
 - b. Glidden Pro: Lifemaster No VOC Semi-Gloss, 9200 Series
 - c. PPG: Pure Performance Semi-Gloss, 9-510 Series
 - d. S-W: Harmony Semi-Gloss, B10 Series
- E. Exposed-to-view metal ductwork, metal conduit, covered and uncovered piping, and all hangers and supports for such items, except in mechanical rooms and maintenance areas:
1. First Coat (for galvanized metal surfaces only): Galvanized metal primer, product of the finish coating manufacturer.
 2. First coat (for unprimed surfaces not galvanized): Metal primer as specified above.
 3. Two Coats: Same finish specified for immediately adjacent surfaces, or as selected by Architect.
- F. Concrete Floor Sealer for exposed concrete flooring:
1. One Coat:
 - a. Prosoco Consolideck LS
 - b. AFM Safecoat AcriGlaze
- G. Interior Concrete Masonry Units for Latex Semi-Gloss Finish:
- One Coat
1. PPG Speedhide Int/Ext Latex Block Filler (28g/l VOC formulation.)
 2. S-W Loxon Block Surfacers
 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

3.9 HIGH PERFORMANCE COATINGS INSTALLATION

- A. Locations: Apply high performance coatings to the following surfaces
1. As indicated in the High Performance Coating Schedule below.
 2. Where shown on Finish Schedule and elsewhere in Drawings.
 3. Exposed interior structural steel and metal deck as indicated.
- B. Areas in which coatings are to be applied shall be kept free of traffic and no other trade shall be permitted to work in such rooms during application and curing of coating.
- C. Hard flooring (concrete, and other) shall be finished before coating work is begun. Soft flooring (resilient flooring, wood flooring, composition flooring, and other) shall not be installed in any area until after coating work is completed.

- D. Painting of surrounding areas and caulking shall be done after coating work is finished. Oil-based or solvent-release caulking compound shall not be used in contact with coating material.
- E. Surfaces to receive coating shall be dry, clean and free of grease. Substrate temperature shall be maintained at a minimum of 60 degrees F., during the application of coating and for at least two weeks thereafter.
- F. Application shall be by skilled applicators regularly engaged in this type of work and in strict compliance with the manufacturer's written instructions. Verify that primers to be applied under other Sections are compatible with the coating systems.
- G. Surfaces not to receive coating shall be effectively masked and protected.

3.10 APPLICATION OF COATINGS

- A. Apply high performance coatings to surfaces by airless spray or roller except as otherwise indicated. Coating thickness shall be adjusted in accordance with manufacturer's written instructions where Architect permits airless spray application. Allow adequate time for base coat to cure before proceeding. Use manufacturer's compatible first coat suitable for each surface to assure uniform finish results.
- B. Apply colored finish coats to all surfaces to minimum dry film thickness indicated. Back roll with roller as required to remove pinholes and unevenness. Allow 24 hours between coats for curing and protect from damage during curing period.
- C. Each coat shall be inspected and approved by the Architect before succeeding coat is applied. Provide a progress schedule showing proposed date of application of each coat for each room, space or area for approval by the Architect. Finish coat shall match approved samples in all respects.

3.11 EXTERIOR HIGH PERFORMANCE COATING SCHEDULE

A. Exterior Metal Surfaces:

- 1. 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 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

And One Coat	1.	Tnemec 1070 Fluoronar at 2.0 mils DFT with 1078 metallic finish (Basis of Design)
	2.	Dupont Fluoropolymer at 3.0 mils DFT
	3.	PPG Coraflon ADS Fluoropolymer at 1.5-2.0 mils DFT

- B. Gypsum wallboard at exterior soffits. Flexible, breathable, water-resistant, elastomeric coating system developed for use on porous exterior surfaces.
 - 1. First Coat: Acrylic Masonry Primer/Sealer
 - a. Glidden Pro: Hydrosealer Primer/Sealer 6001 Series
 - b. PPG: Perma Crete Primer, 4-2
 - c. S-W: Loxon Masonry Conditioner, A24-100
 - 2. Two Coats: Flexible, breathable, water-resistant, elastomeric coating
 - a. Glidden Pro: Decraflex 300, 2260 Smooth
 - b. PPG: Perma Crete Pitt Flex, 4-110/4-310 Series
 - c. S-W: Loxon Smooth A24W300 or Con-Flex, A5-400 Series

3.12 INTERIOR HIGH PERFORMANCE COATING SCHEDULE

- A. Ferrous metal doors, doorframes and borrowed light frames: Water-based polyurethane coating system.
 - 1. First Coat: Manufacturer's standard rust-inhibiting primer provided under Section specifying item to be coated.
 - 2. Two Coats: Two-component, acrylic polyurethane coating, gloss finish.
 - a. Ben Moore: WB Urethane Gloss, P73 Series
 - b. Devoe Coatings: Devthane Urethane Gloss, 379H Series
 - c. PPG: Durethane WB Urethane, 98-8200 Series
 - d. S-W: Waterbased Acrolon Polyurethane 100, B65-720
- B. Ferrous metal stairs, railings and other shop-primed, non-galvanized miscellaneous metal items subject to high wear and abuse. Water-based polyurethane coating system.
 - 1. First Coat: Shop-applied, zinc-rich, aromatic urethane primer, provided under Section 05500 – MISCELLANEOUS METALS.
 - 2. Two Coats: Two-component, acrylic polyurethane coating, gloss finish.
 - a. Ben Moore: WB Urethane Gloss, P73 Series
 - b. Devoe Coatings: Devthane Urethane Gloss, 379H Series
 - c. PPG: Durethane WB Urethane, 98-8200 Series
 - d. S-W: Waterbased Acrolon Polyurethane 100, B65-720
- C. Ferrous metal structural deck, and structural steel. Dry-fall acrylic coating.
 - 1. One Coat: Flat finish:
 - a. Glidden Pro: Acrylic Dryfall Flat, 1280 Series
 - b. PPG: Super Tech WB Dryfall Flat, 6-725 Series
 - c. SW: WB Acrylic Dryfall Flat, B42W1
 - 2. Colors: The color for steel deck shall be different than the color for steel framing. Provide colors as selected by Architect.
- D. Interior drywall surfaces in Toilet Rooms, Corridors, Stairways, Kitchen:
 - 1. 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

E. Interior Concrete Block:

1. 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 sq/ft/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

3.13 MAINTENANCE SUPPLY

- A. Furnish at least five (5) gallons of each type and color of paint and finish as maintenance supply for Owner's future use. Include high performance coatings.
- B. Deliver in unopened sealed containers with clearly legible manufacturer's label indicating contents. Store in building in maintenance area where directed.

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. Interior Markerboards.
 - 2. Interior Tackboards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. 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.
- C. Maintenance Data: For markerboard and tackboard surfaces to include in maintenance manuals. Include data on regular cleaning and stain removal.
- D. Samples:
 - 1. 12" square samples of markerboard and tackboards with frame.
 - 2. Manufacturer's standard sample board in all available colors, for selection by Architect.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide materials with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

- D. Coordinate with General Contractor and other trades for wall mounted items that may impact the mounting of visual display surfaces. Coordinate with the General Contractor for requirements of blocking required within walls to support visual display surfaces. Indicate required blocking on shop drawing submittal.

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 Architect. When overall dimensions require delivery in separate units, prefabricate 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.

1.7 WARRANTY

- A. Warranty: Provide manufacturer's standard "life of building" warranty for the Porcelain enamel steel markerboard writing surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. AARCOO Products, Inc.
 - 2. Claridge Products and Equipment, Inc.
 - 3. Steelcase.
 - 4. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Claridge Products and Equipment, Inc., to establish the general character and materials required for (materials of this section) materials for this project. Equivalent products by acceptable manufacturers will be approved.

2.2 MARKERBOARD

- A. Markerboard (MB): Provide manufactured boards of dimensions indicated, complete with

magnetic facing, core, backing and trim.

- B. Facing: 24 gauge minimum magnetized steel with Type A acid-resistant porcelain enamel finish.
 - 1. Units shall be in one piece with no seams as far as possible. If size exceeds manufacturer's limitations, provide boards with edges milled square and true to permit tight butt joints between panels. Joints, if any, shall be symmetrically spaced.
 - 2. Color: Claridge, *No. LCS3 No. 100 White (Low Gloss)*, *AARCO Series 10-007 V2 Low Gloss Off-White*, *Steelcase e3* or approved equal; as selected by Architect.
 - 3. Permanent Markings: Provide music staff permanently painted to surface of markerboard where indicated on drawings.
- C. Core and Backing: 3/8" particleboard core with 0.002 inch thick aluminum foil backing.
- D. Adhesive: As recommended by the manufacturer and as approved. Do not use asphaltic mastics. All fastenings shall be concealed.
- E. Product: Claridge Products and Equipment, *Series 8 LCS Porcelain Enamel Steel Markerboard*, or equal by approved manufacturer.
- F. Tack Strips: Provide aluminum trimmed tack strips with markerboards at locations indicated on Drawings.

2.3 FRAMED TACKBOARD

- A. Tackboard: Provide manufactured boards of dimensions indicated, complete with facing, core, backing and trim.
- B. Facing: 1/4" thick self-healing cork composite bonded to jute backing.
 - 1. Recycled Content: Provide cork material that contains 40 percent post-industrial recycled content.
 - 2. Surface of cork shall be washable.
 - 3. Color: Provide up to 4 different colors throughout project as selected by Architect from manufacturer's full range.
- C. Backing: 1/4" thick tempered hardboard.
- D. Adhesives: As recommended by the tackboard manufacturer for full permanent adhesion.
 - 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).
- E. Product: Series 1100 Claridge Products and Equipment, *Cork Bulletin Board*, *AARCO VIC Cork Series 10-013*, or equal by approved manufacturer.

2.4 STANDARD TRIM

- A. General:
 - 1. Type of Trim: Factory built trim.
 - 2. Material: Clear anodized aluminum, satin finish.
 - 3. Mounting: Built-in concealed hangers for all locations.

- B. Map Rail: Integral head trim with map rail with cork insert with color matching framed tack-board color selection(s).
 - 1. Locations: Markerboards.
 - 2. Provide end stops for map rail.
 - 3. Product: Claridge standard maprail, AARCO No 10-124, or equal by approved marker-board manufacturer.
- C. Edge Trim: J-profile edge trim with exposed face width not exceeding 3/4 inch.
 - 1. Locations: Sides of markerboards; sides, tops, and bottom of tackboards.
 - 2. Product: Claridge, Series 8, AARCO Series 10-121, Steelcase "The Edge" or approved equal.
- D. Marker Tray: Solid ribbed blade-type tray, narrow profile with injection molded end closures.
 - 1. Locations: Markerboards
 - 2. Product: Claridge blade-type marker trough, AARCO No 10-122 or approved equal.
- E. Divider Trim: Pre-finished in flat enamel of color to match selected markerboard color,
 - 1. Locations: Intermediate dividers of multi-panel markerboards.
 - 2. Product: Manufacturer's standard divider bar.

2.5 ACCESSORIES

- A. Map hooks: Aluminum spring-clip hooks designed for use on specified map rail.
 - 1. Locations: 4 per map rail, at all markerboards.
 - 2. Product: Claridge *No. 51M*, or equal.
- B. Flag holder: Aluminum flag holder designed for use on specified map rail.
 - 1. Locations: 1 per map rail.
 - 2. Product: Claridge, *No. 51FH*, or equal.

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. Verify before installation that interior moisture and temperature approximate normal occupied conditions.
- C. 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.

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 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 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. Cast metal plaques and medallions.
 - 4. Interior signs for assisted listening devices.
 - 5. Interior signs for the occupancy posting of Assembly Spaces (Cafeteria, Gymnasium, Library). One sign shall be required at each exit doorway of each such space.
 - 6. Interior signage for new fire and smoke partitions.
 - 7. Evacuation diagrams.
 - 8. Additional signage as indicated.
- B. 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. Exterior building signage: Section 055000 – METAL FABRICATIONS.
 - 3. Gypsum wallboard construction: Section 092900 – GYPSUM BOARD ASSEMBLIES.
 - 4. Assisted listening device system: Section 260000 – ELECTRICAL
 - 5. Fire alarm annunciator panel and diagram of building: Section 260000– ELECTRICAL.

1.4 REFERENCE STANDARDS

- A. Americans with Disabilities Act (ADA).

- B. ICC/ANSI A117.1-2009.

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.

1.6 SUBMITTALS

- A. Submit Shop Drawings, samples and manufacturer's data in accordance with the requirements of Section 013300 - Submittals.
- B. 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.
- C. Schedules: Submit schedule of all room signs indicating type, text and graphics for each door or other location where a sign is required.
- D. 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.
- E. 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. Cast Metal Plaques:
 - 1. Matthews International Corporation; Bronze Division.
 - 2. Metal Arts; Div. of L&H Mfg.
 - 3. The Southwell Company.
- C. 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. Bronze Castings: ASTM B 584, alloy UNS No. C83600 (No. 1 manganese bronze)
- B. Extruded Aluminum Bars, rods, Shapes and Tubes: ASTM B 221, 6063 alloy.
- C. Aluminum Sheet and Plate: ASTM B 209, alloy 1100, 3003 or 5052.
- D. 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.
- E. 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.
- F. 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. Each Text Telephone (TTY).
 - c. Elevator lobby on each floor.
 - d. Each exit door marked with an electronic exit sign.

- e. Each assisted listening system location.
 - f. Electric Rooms: "Dedicated Electric Room, No Storage Allowed".
 - g. Elevator Machine Rooms: "Elevator Machine Room, No Storage Allowed".
 - h. Exterior panel signs for each roof access point: "'Caution: Roof surface very slippery when wet".
 - i. Elevator code sign (pictorial) at the elevator Lobby: "IN FIRE EMERGENCY DO NOT USE ELEVATOR. USE EXIT STAIRS".
 2. Room signs with removable name slots: Classrooms, Offices, Art, Music, ESL, Resource, OT/PT, Speech/Language, Library, and Gym. Provide manufacturer's standard removable name slot for each sign at these locations.
 3. Locate signs where shown on Drawings and determined by the Architect.
 4. All signage shall be in conformance with the following:
 - a. Americans with Disabilities Act, "Accessibility Guidelines for Buildings and Facilities."
 - b. ANSI.
 5. Room Occupancy Signs: Provide room occupancy signs with text indicating maximum allowable occupancy of room, as determined by the Architect.
 6. Evacuation Diagrams: Provide building evacuation diagrams in accordance with drawings and as required by authorities having jurisdiction.
- 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: 3/4 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: 20
 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: 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 CAST METAL PLAQUES

- A. Dedication Plaques and School Emblem Medallion:
 - 1. General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy
 - 2. Dimensions and Configuration: Two (2) plaques at 24 inches wide by 36 inches tall, and one (1) medallion with school logo, refer to drawings.
 - 3. Location: As selected by Architect.
 - 4. Thickness: Not less than 3/8 inch (9 mm).
 - 5. Material: Cast bronze.
 - 6. Letters: Raised letters with polished faces in type face selected by Architect.
 - 7. Text: Layout and design, including border, will be provided by Architect in camera-ready form.
 - 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. Cast metal plaques and medallion shall be installed by means of concealed, vandal-resistant fastening method at interior location selected by Architect.

2.6 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"

2.7 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 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.

3.4 INSTALLATION OF IDENTIFICATION FOR FIRE AND SMOKE PARTITIONS

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

3.5 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 102100

TOILET COMPARTMENTS AND 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. Floor-mounted overhead-braced toilet partitions and wall-hung urinal screens fabricated from recycled plastic.
- B. Related Work: The following items are not included in this Section and will be performed 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. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Show locations of cutouts for compartment-mounted toilet accessories.
- C. 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.

1.5 WARRANTY

- A. Provide manufacturer's standard warranty guaranteeing plastic against breakage, corrosion and delamination for a minimum of 15 years.

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. AJW Architectural Products
 - 2. Global Partitions.
 - 3. Scranton Products, Inc.
- B. Basis of Design: Provide Hiny Hiders as manufactured by Scranton Products, Inc.; or approved equal.
- C. Door, Panel, and Pilaster Construction: Solid, recycled high-density polyethylene 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 as selected by Architect from manufacturer's available range of colors and patterns.
 - 2. Fire hazard classification: Pass NFPA 286.
 - 3. Recycled Content: Minimum 30 percent total recycled content.
- D. Pilasters and Fittings: Manufacturer's standard design and as specified herein.
- E. Urinal Screens: Provide urinal screens fabricated from same material as toilet partitions.
 - 1. Urinal Screen Sizes: Provide 42" high by 18" deep between urinals, and 24" deep between urinal and sink or circulation path.

2.2 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
- B. Brackets: Provide panel manufacturer's heavy-duty, continuous extruded aluminum brackets for panel to panel, and panel to wall connections.
- C. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- D. 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. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- B. Doors: Unless otherwise indicated, provide 24-inch-wide in-swinging or out-swinging doors as indicated on drawings for standard toilet compartments and 36-inch-wide in-swinging or out-

swinging doors as indicated on drawings with a minimum 32-inch-wide clear opening for compartments indicated to be accessible to people with disabilities.

1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
2. Latch and Keeper: Manufacturer's standard latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.
3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

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.
 2. Wall Brackets: Attach panels to walls with continuous wall brackets and anchoring devices to suit supporting structure. Set units level and plumb and to resist lateral impact.
 - a. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less 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.

3.2 ADJUSTING

- A. Self-Closing Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. At non-accessible stalls, set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched and set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position. At accessible stalls, set hinges on out-swinging doors, in-swinging doors and doors in entrance screens to return doors to fully closed position.

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 the following products for installation under this section.
 - a. Toilet paper holders.
 - b. Sanitary napkin vendors and disposals.
 - c. Mirrors and shelves.
 - d. Grab bars.
 - e. Accessories for custodial closets.
 - f. Robe hooks.
 - g. Shower accessories.
 - h. Changing stations.
 - i. Paper towel waste receptacles and dispensers.
 - j. Soap dispensers.
 - k. Electric hand dryers.
 - 2. Coordinate and provide blocking, recesses and openings for Owner provided toilet accessories including but not limited to paper towel and soap dispensers.
- B. 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. Electrical wiring and connection to electric hand dryers: 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.

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., Yonkers, N.Y.
 - b. Bobrick Washroom Equipment, Inc., N. Hollywood, CA.
 - c. A & J Washroom Accessories, Pittsburg, PA.
 - d. Bradley Corporation, Germantown, WI.
 - e. Approved equal.

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) or polished chrome (US 26).

2.3 TOILET ACCESSORIES, GENERAL

- A. Quantities: Furnish accessories in quantities as indicated on drawings and as indicated below.
- 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 dry-wall 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. 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 TOILET PAPER HOLDERS

- A. Surface-Mounted Toilet Paper Holder [TP-S]:
 - 1. Description: Surface-mounted multi-roll toilet paper dispenser holding two rolls of standard core, 1500-sheet rolls.
 - a. Extra roll shall automatically drop into place after bottom roll is used up.
 - b. Construction: Satin finish heavy-duty welded 304 stainless steel with tumbler lock.
 - 2. Locations: As shown on Drawings.

3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-2888.
 - b. American Specialties, Inc., Model No. 0030.
 - c. A&J Washroom Accessories, Model U840.
 - d. Bradley Corp., Model 5402.
 - e. Or approved equal.
- B. Recessed Toilet Paper Holder [TP-R]:
 1. Description: Recessed multi-roll toilet paper dispenser holding two rolls of standard core, 1500-sheet rolls.
 - a. Extra roll shall automatically drop into place after bottom roll is used up.
 - b. Construction: Satin finish heavy-duty welded 304 stainless steel with tumbler lock.
 2. Locations: As shown on Drawings.
 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-3888.
 - b. American Specialties, Inc., Model No. 0031.
 - c. A&J Washroom Accessories, Model U841.
 - d. Bradley Corp., Model 5412.
 - e. Or approved equal.
- C. Recessed Toilet Paper Holder side-by-side unit for Pre-K Toilet Rooms [TP-R1]:
 1. Description: Recessed dual-roll toilet paper dispenser holding two rolls of standard core, 1500-sheet rolls.
 - a. Side by side rolls equipped with 18 gauge hoods hinged to shell.
 - b. Construction: Satin finish heavy-duty welded 304 stainless steel with tumbler lock.
 2. Locations: Within Pre-K Toilet Rooms and elsewhere when grab bars are required or shown to be lower than 25" mounting height.
 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-6997.
 - b. American Specialties, Inc., Model No. 74022-H.
 - c. A&J Washroom Accessories, Model UX76-SF.
 - d. Bradley Corp., Model 5123.
 - e. Or approved equal.
- D. Surface Mount Toilet Paper Holder side-by-side unit for Pre-K Toilet Rooms [TP-S1]:
 1. Description: Surface mounted dual-roll toilet paper dispenser holding two rolls of standard core, 1500-sheet rolls.
 - a. Side by side rolls equipped with 18 gauge hoods hinged to shell.
 - b. Construction: Satin finish heavy-duty welded 304 stainless steel with tumbler lock.
 2. Locations: Within Pre-K Toilet Rooms and elsewhere when grab bars are required or shown to be lower than 25" mounting height.
 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-69997.
 - b. American Specialties, Inc., Model No. 74022-HSM.
 - c. A&J Washroom Accessories, Model UX76-SF-SM.
 - d. Bradley Corp., Model 5126.
 - e. Or approved equal.

2.5 SANITARY NAPKIN VENDORS AND DISPOSALS

A. Surface Mounted Sanitary Napkin Vendor [SNV-S]:

1. Description: Coin-operated surface mounted feminine napkin and tampon vendor.
 - a. Body: Type 304 welded stainless steel with #4 satin finish.
 - b. Provide individual locks for door and coin box with separate keys.
2. Locations: One in each multiple-user girls' or women's toilet room, and one in each single-user toilet room, as indicated on Drawings.
3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-2706
 - b. American Specialties, Inc., Model No. 0864
 - c. A&J Washroom Accessories, Model U526-SM
 - d. Bradley Corp., Model 407-11
 - e. Or approved equal.

B. Recessed Sanitary Napkin Vendor [SNV-R]:

1. Description: Coin-operated recessed feminine napkin and tampon vendor.
 - a. Body: Type 304 welded stainless steel with #4 satin finish. Construction shall be as specified for Long Type towel dispenser/disposal above.
 - b. Provide individual locks for door and coin box with separate keys.
2. Locations: One in each multiple-user girls' or women's toilet room, and one in each single-user toilet room, as indicated on Drawings.
3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-3706.
 - b. American Specialties, Inc., Model No. 04684.
 - c. A&J Washroom Accessories, Model U526.
 - d. Bradley Corp., Model 407.
 - e. Or approved equal.

C. Surface-Mounted Napkin Disposal Units [SND-S]:

1. Description: Surface-mounted disposal units, with self-closing panel and removable waste receptacle.
 - a. Body: Satin finish in 18-gauge type 304 stainless steel, welded construction, completely enclosed.
 - b. Door shall unlock and be easily removable for servicing.
2. Locations: Where shown on Drawings, but no less than required to give access to a unit in each cubicle in every toilet room having napkin dispenser.
3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-254.
 - b. American Specialties, Inc., Model No. 0473-A.
 - c. A&J Washroom Accessories, Model U582.
 - d. Bradley Corp., Model 4737-11.
 - e. Or approved equal.

D. Recessed Napkin Disposal Unit [SND-R]:

1. Description: Recessed end-wall disposal units, with self-closing panel and removable waste receptacle..
 - a. Body: Satin finish in 18-gauge type 304 stainless steel, welded construction, completely enclosed.
 - b. Door shall unlock and be easily removable for servicing.

2. Locations: At end walls, where shown on Drawings, but no less than required to give access to a unit in each cubicle in every toilet room having napkin dispenser.
3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-35303.
 - b. American Specialties, Inc., Model No. 0473.
 - c. A&J Washroom Accessories, Model U581.
 - d. Bradley Corp., Model 4737.
 - e. Or approved equal.

2.6 MIRRORS AND SHELVES

A. Standard Mirrors [MIR]:

1. Description: Framed mirror with one-piece roll-formed frame
 - a. Dimensions: 18" x 36" in toilet rooms. and as shown on Drawings.
 - b. Frame: 3/4" x 3/4" of heavy gauge, type 304 stainless steel angle with satin finish; include continuous integral stiffener on all sides for added strength. Corners shall be heliarc welded, ground and polished smooth.
 - c. Glass: Mirror edges shall be protected with plastic filler strips to prevent chipping.
 - d. Back shall be protected by 1/4" thick, waterproof, shock-absorbing polystyrene padding. Provide 20 gauge galvanized steel back attached to frame with concealed screws.
 - e. Mounting: Mirror shall be installed on concealed wall hanger and secured in place by theft-proof locking screws with tool provided.
2. Locations: Where shown on Drawings.
3. Product: Bobrick Washroom Equipment, Inc., *B-290*, or equal by approved manufacturer.

B. Frameless Mirrors [MIRwoF]:

1. Description: Frameless mirror.
 - a. Dimensions: 18" x 36" in Pre-K and Kindergarten toilet rooms, and as shown on Drawings.
 - b. Glass: Mirror edges shall be polished.
 - c. Back shall be protected by 1/4" thick, waterproof, shock-absorbing polystyrene padding.
 - d. Mounting: Mirror shall be installed with a minimum six (6) plastic clips and secured in place by theft-proof locking screws with tool provided.
2. Locations: Where shown on Drawings.
3. Product:
 - a. American Specialties, Inc., *Model No. 8287*.
 - b. A&J Washroom Accessories, *Model U701*.
 - c. Bradley Corp., *Model 747*.
 - d. Or approved equal.

C. Toilet Room Shelf [SHLF]:

1. Description: Surface mounted shelf.
 - a. Dimensions: 6" deep x 18" long.
 - b. Construction: 18 gauge minimum 304 stainless steel with satin finish. Edges shall be turned down a minimum 1/2" for additional rigidity. Edges shall be hemmed for safe handling.
 - c. Mounting: 16 gauge minimum brackets (minimum two per shelf).

2. Locations: Provide one shelf within each single-user toilet room and other locations shown on Drawings.
3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-296.
 - b. American Specialties, Inc., Model No. 0692.
 - c. A&J Washroom Accessories, Model U776.
 - d. Bradley Corp., Model 756.
 - e. Or approved equal.

2.7 GRAB BARS

A. Typical 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 as indicated on Drawings.
4. Locations: Multiple-user and single-user toilet rooms, except for those used by pupils in Pre-kindergarten toilet rooms.
5. Product:
 - a. Bobrick Washroom Equipment, Inc., B-5806.99.
 - b. American Specialties, Inc., Model No. 3700.
 - c. A&J Washroom Accessories, Model UG2-A.
 - d. Bradley Corp., Model 832.
 - e. Or approved equal.

B. Pre-K Children's Grab Bars [GB-C]:

1. Description: 1-inch o.d. concealed mounting, customized if needed to conform to specifications.
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" from wall.
 - a. Typical: 36 inches (914 mm), 42 inches (1.07 m), as indicated on Drawings.
4. Locations: Single-user toilet rooms used by pupils in Pre-kindergarten classrooms.
5. Product:
 - a. Bobrick Washroom Equipment, Inc., B-530, customized to provide peened gripping surface and custom lengths.
 - b. American Specialties, Inc., Model No. 3000.
 - c. A&J Washroom Accessories, Model UG1X-A.
 - d. Bradley Corp., Model 852.
 - e. Or approved equal.

- C. Shower Grab Bars [GB-S]:
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. At 36 inch x 36 inch shower stalls: L-shaped grab bar with min. dimension of 18" one length and 30" other length (maximum overall dimension from wall to escutcheon shall not exceed 36". Provide also one min. 18" long bar mounted vertically above the horizontal bar. Alternatively: provide separate straight bars of the following dimensions: 18" horizontal on one wall, 30" horizontal on other wall, 18" high vertical bar mounted above the 30" bar. Refer also to drawings.
 4. Locations: Provide at each Accessible Shower.
 5. Product:
 - a. Bobrick Washroom Equipment, Inc., B-5806 (*separate straight bars*).
 - b. American Specialties, Inc., Model No. 3700 Type 60 and 3700-18.
 - c. A&J Washroom Accessories, Model UG2-G and UT2-A-18.
 - d. Bradley Corp., Model 832-034/035.
 - e. Or approved equal.

2.8 ACCESSORIES FOR CUSTODIAL CLOSETS

- A. Broom Holder [BH]:
1. Description: Stainless steel, minimum 34" long mounting strip with 3 mop holders, four (4) hooks and a minimum 8" deep shelf.
 - 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:
 - a. Bobrick Washroom Equipment, Inc., B-239.
 - b. American Specialties, Inc., Model No. 1308.
 - c. A&J Washroom Accessories, Model UJ45.
 - d. Bradley Corp., Model 9933.
 - e. Or approved equal.

2.9 ROBE HOOKS

- A. Surface-Mounted Robe Hook [RH]
1. Description: Single-prong unit with concealed mounting.
 - a. Material: 14-gauge, type 304 stainless steel with satin-finish.
 2. Locations, on the back of the door:
 - a. Each single-user toilet room.
 - b. Custodial Office.
 - c. Gym Office.
 - d. Principal.
 - e. Nurse.

- f. Guidance.
- g. All four Reading Offices.
- h. ESL.
- i. Resource.
- j. OTPT.
- k. SP/ Lang.
- l. Sped Office.
- 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-76717.
 - b. American Specialties, Inc., Model No. 7340-S.
 - c. A&J Washroom Accessories, Model UX110-SF.
 - d. Bradley Corp., Model 9114.
 - e. Or approved equal.

2.10 SHOWER ACCESSORIES

A. Shower Curtain, Rod and Hooks:

- 1. Description:
 - a. Curtain material: Opaque, matte white vinyl, min 0.008" thick, containing antimicrobial and flame retardant agents and with hemmed edges.
 - b. Hooks material: Type 304 stainless steel, min. thickness 0.090" diameter wire.
 - c. Rod material: Extra Heavy Duty 1 1/4" diameter 18-ga type 304 stainless steel with satin finish.
- 2. Locations:
 - a. At each shower. Provide 36" rod length and 42" wide x 72" high curtain or as otherwise shown on drawings.
- 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-204 Curtain, 204-1 Hooks and B-6047 Rod.
 - b. American Specialties, Inc., 1200-V Curtain, 1200-SHU Hooks, 1204 Rod.
 - c. A&J Washroom Accessories, UX-250P Curtain, UX169 Hooks, UX2C Rod.
 - d. Bradley Corp., 9533 Curtain, 9536-US Hooks, 9539 Rod.
 - e. Or approved equal.

B. Shower Seat: [SST]

- 1. Description: Reversible solid phenolic folding shower seat.
 - a. Seat material: minimum 1/2" thickness solid phenolic seat with integral slots for drainage.
 - b. Frame: 18-8 type 304 stainless steel with satin finish.
- 2. Locations:
 - a. At each Accessible shower and as shown on Drawings. Right-Hand or Left-Hand configuration as shown on Drawings.
- 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-5181.
 - b. American Specialties, Inc., Model 8206.
 - c. A&J Washroom Accessories, Model U929.
 - d. Bradley Corp., Model 9569.
 - e. Or approved equal.

2.11 CHANGING STATION [CS-R]

A. Baby Changing Station [CS-B]:

1. Material: 18 gauge, type 304 satin stainless steel exterior finish with high density polyethylene interior.
2. Features: Nylon safety straps, bag hooks, safety instructions, pneumatic cylinder, concealed hinges, and liner dispenser.
3. Product:
 - a. Bobrick Washroom Equipment, Inc.: KB-110-SSRE.
 - b. American Specialties, Inc., Model 9013.
 - c. A&J Washroom Accessories, Model U986.
 - d. Bradley Corp., Model 962.
 - e. Or approved equal.

B. Child Changing Station [CS-C]:

1. Description: 59" long by 26" wide folding hinged shower stretcher/changing table with hinged leg supports. Unit shall fold against wall and shall include a wall clamp to secure to wall.
2. Product:
 - a. Handicare US, Linido Shower Stretcher Model LI12403.150.
 - b. Sammons Preston, Model 452101.
 - c. Or approved equal.

2.12 PAPER TOWEL WASTE RECEPTACLES AND DISPENSERS

A. Paper Towel Waste Receptacle [WR-SR-12] [WR-SR-18]:

1. Description: Recessed unit with removable waste receptacle.
 - a. Body: 18-gauge 304 stainless steel welded construction with a 1/2"-90 degree return.
 - b. Waste receptacle: 22 gauge 304 stainless steel with top and bottom edges hemmed and shall have 12 gallon [WR-SR-12] or min 18 gallon [WR-SR-18] capacity; receptacle shall be locked to cabinet; include one package of vinyl liners for each unit provided.
 - c. Cabinet shall be provided with locking devices keyed alike with other cabinets.
2. Locations: As indicated on Drawings.
3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-3644 (12 gal) and B36860 (18 gal).
 - b. American Specialties, Inc., Model No. 0458 (12 gal) and 0458-DX (18 gal).
 - c. A&J Washroom Accessories, Model U410 (12 gal) and U412 (21 gal).
 - d. Bradley Corp., Model 344 (12 gal) and 334 (18 gal).
 - e. Or approved equal.

B. Paper Towel Dispenser/Waste Receptacle [PTD/WR-SR-12] [PTD/WR-SR-18]:

1. Description: Combination unit for dispensing preset length of roll paper towels, with removable waste receptacle.
 - a. Body: 18-gauge 304 stainless steel welded construction with a 1/2"-90 degree return.
 - b. Door: 18-gauge seamless Type 304 steel on stainless steel piano hinge.
 - c. Paper towel dispenser: Manually operated dispenser shall hold a single 8-inch diameter roll of paper towels.
 - d. Waste receptacle: 22 gauge 304 stainless steel with top and bottom edges hemmed and shall have 12 gallon [PTD/WR-SR-12] or minimum 18 gallon [PTD/WR-SR-18] capacity; receptacle shall be locked to cabinet; include one pack-

- age of vinyl liners for each unit provided.
- e. Cabinet shall be provided with locking devices keyed alike with other cabinets.
- f. Mounting: Semi-recessed-mounted.
- 2. Locations: As indicated on Drawings.
- 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-3961 (12 gal) and B-39617 (18 gal)
 - b. American Specialties, Inc., Model No. 046924 (12 gal) and 046924-BL (18 gal)
 - c. A&J Washroom Accessories, Model U-659AW (12 gal) and U-XXXX (21 gal)
 - d. Bradley Corp., Model 2497 (XX gal) and 227 (18 gal)
 - e. Or approved equal.

2.13 SOAP DISPENSERS

A. Liquid Soap Dispenser-surface mounted [SD-S]:

- 1. Description: Surface-mounted liquid soap dispenser with concealed vandal-resistant mounting.
 - a. Body: min 22-gauge, one-piece, seamless, Type 304 welded stainless steel with #4 satin finish. Unit shall be equipped with a clear acrylic refill-indicator window.
 - b. Valve: corrosion resistant valve with molded plastic push button and spout. Valve shall dispense commercially marketed all-purpose hand soaps. Valve shall operate with no more than 5lb of force.
 - c. Provide lockable, hinged stainless steel lid for top filling.
 - d. Shall have a capacity of minimum 40-fl oz.
- 2. Locations: as indicated on Drawings in Toilet Rooms and Showers.
- 3. Product:
 - a. Bobrick Washroom Equipment, Inc., B-2111.
 - b. American Specialties, Inc., Model No. 0347.
 - c. A&J Washroom Accessories, Model U126.
 - d. Bradley Corp., Model 6563.
 - e. Or approved equal.

2.14 ELECTRIC HAND DRYERS

A. Surface mounted warm air, high-speed self-contained hand dryer [HD-S]:

- 1. Description: Warm air, rapid drying, energy efficient electric hand dryer; surface mounted; entire dryer internally grounded.
 - a. Controls: Completely sealed control assembly and optics for protection against moisture, lint/dust and vandalism. Automatic, activated by infrared optical sensor. Operates while hands are under blower. Shut-off within 2 seconds when hands removed or in 35 seconds if hands not removed.
 - b. Cover: Stainless steel with brushed finish.
 - c. Air Intake: Small circular Inlet openings on bottom of cover.
 - d. Air Outlet: Delivers focused air stream of 18,000 LFM at nozzle and 16,000 LFM at average hand position of 4 inches (102 mm) below air outlet.
 - e. Noise Reduction Nozzle: 1.1 noise reduction nozzle. Reduces air deflection noise and decibel level by 9db.
 - f. Nominal Size: 11-3/4 inches (298 mm) wide by 12-11/16 inches (322 mm) high by 6-11/16 inches (170 mm) deep.
- 2. Locations: as indicated on Drawings in Toilet Rooms.
- 3. Product:

- a. Xlerator model XL-W by Excel Dryer, Inc; East Longmeadow, MA 01028.
- b. Bobrick Washroom Equipment, Inc., B-770.
- c. American Specialties, Inc., Model TRI-Umph 20200.
- d. Bradley Corp., Model 2922-2873.
- e. Or approved equal.

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 room accessories.

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, blankets, at indicated locations.
 - 3. Mounting brackets for fire extinguishers.
 - 4. Fire Department emergency key vault.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 210000 - 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. 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 FIRE EXTINGUISHERS

- A. Dry chemical fire extinguishers: For class ABC fires, 10-pound capacity, UL rated 4A-40BC, enameled steel case.
 - 1. Locations: Provide dry chemical fire extinguishers at designated locations where shown on the drawings and provide (1) one bracket mounted extinguisher in each of the electrical and mechanical rooms.
 - 2. Product: J.L. Industries, *Cosmic Model 10E*; Larsen's Manufacturing Company, *MP-10*; Potter Roemer Fire Pro, *Model 3010*, or equal by approved manufacturer.
- B. Wet Chemical type fire extinguishers: For class K fires, potassium acetate based, low PH agent, 2-1/2 gallon capacity, UL rated 2AK, stainless steel case
 - 1. Locations: Provide wet chemical type fire extinguishers for kitchens and at locations indicated on the Drawings.
 - 2. Product: J.L. Industries, Saturn 25, Larsen's Manufacturing Co., *WC21/2*; Potter Roemer Fire Pro *Model 3262*, or equal by approved manufacturer.
- C. Deliver fire extinguishers immediately prior to inspection for Substantial Completion, or when directed by Architect. Fire extinguishers provided under this Section shall not be used for temporary fire protection during construction.

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: Cosmopolitan 1035-W17 Typical. Model 3637-W17 semi-recessed fire-blanket/fire extinguisher cabinet at Science laboratories. FX model when installed in Fire-Rated partitions. Cabinets to be provided with optional Saf-T-Lok.
 - 2. Larsen's Manufacturing Company: Model 2409-R2 Typical. 3612-RL semi-recessed fire-blanket/fire extinguisher cabinet at Science Laboratories. FS model when installed in Fire-Rated partitions. Cabinets to be provided with optional Larsen-Loc.
 - 3. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Type: Suitable for fire extinguisher. In Chemistry Labs, provide larger cabinet with space for fire blankets.

- C. Cabinet Material: Steel with baked-enamel finish or Stainless steel.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
 - 1. Exposed Flat Trim: One-piece, 5/16" or 3/8" flat stainless steel combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Door Material: #4 Stainless Steel.
- F. Door Style: Vertical duo panel with frame.
- G. Door Glazing: Tempered break glass.
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- I. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
 - 3. Identification: Vertical Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 4. Fire Blankets: Provide fire blankets at each cabinet in Science Laboratories.

2.3 FIRE DEPARTMENT KNOX BOX KEY (VAULT) CABINET

- A. Provide recessed mounted, fire department Knox Box Key (Vault) Cabinet at building entrance; location shall be acceptable to local Fire Department.
- B. Knox box shall be equal to Model 3200 Knox-Box, Recessed Mounted Type, manufactured by The Knox Company, Irvine, CA 92614.
 - 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.

2.4 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.

2.5 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. At fire rated construction, 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.

2.6 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.
- 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. Comply with MAAB/ADA Accessibility requirements.
- 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 semi-recessed fire-protection cabinets.
 - 2. 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.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, 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.

END OF SECTION

SECTION 105100
LOCKERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

- 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.

1.02 SUMMARY

- A. The Work of this Section includes, but is not limited to, the following:
 - 1. Student and athletic lockers, existing lockers shall be refinished and reinstalled.
 - 2. Stackable lockers.
- B. Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Wood blocking, and wood bases for student lockers: Section 061000 – ROUGH CARPENTRY.

1.03 SUBMITTALS

- A. Submit the following, in accordance with requirements of Section 013300 – Submittal Procedures.
- B. Shop Drawings: Submit complete Shop Drawings, including
 - 1. Layout of lockers, closures, tops and filler panels in each area.
 - a. Label locker layout with numbering scheme to be used for number plate on each locker.
 - b. Identify locations of handicapped accessible lockers.
 - 2. Large scale details of locker construction and details of accessory items.
 - a. Indicate methods of installation.
 - 3. Provide fastener BOCA reports and catalogue data.
- C. Colors: Submit manufacturer's standard color chips (minimum of twelve (12) colors) for selection by the Architect. Three colors will be required. Body and frame of locker will be the same color.
- D. Samples: Provide samples of each type of door construction with number plate and sample of

each type of locking device and accessory item.

- E. Lock combination listings and Master keys.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the following:
 - 1. U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)"
 - 2. ICC/ANSI A117.1-2003

1.05 GUARANTEES

- A. Manufacturer shall guarantee in writing all lockers for not less than ten (10) years from date of installation against defects in materials and workmanship.
- B. Such guarantee shall be in addition to and not in lieu of all other liabilities manufacturer and Contractor may have by law or by other provisions of the Contract.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with specifications, acceptable manufacturers include but are not limited to the following:
 - 1. List Industries.
 - 2. Medart, Inc.
 - 3. Penco Products, Inc.
 - 4. Republic Steel Corp.
 - 5. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Republic Steel Corporation, to establish the general character and materials required for lockers for this project. Equivalent products by acceptable manufacturers will be approved.

2.02 MATERIALS

- A. Sheet Steel: Mild cold-rolled steel, free from buckle, scale and surface imperfections.
- B. Hardware: Stainless steel or metal alloy with rust-resistant finish, chrome plated as indicated.
- C. Fasteners: Cadmium, zinc, or nickel plated steel; slotless type exposed bolt head; self-locking nuts or locking washers and nuts.

2.03 EXISTING LOCKERS

- A. Refinish existing lockers using electro-statically applied paint system.

2.04 STACKABLE LOCKERS

- A. General: Multi-tier, heavy-duty lockers.
- B. Product: Republic Storage Systems, *Standard Locker*, or approved equal furnished complete with all required closures, fillers, and trim.
- C. Types:
 - 1. Six-tier: 12 inches wide, 12 inches deep, and 12 inches high, on metal legs with metal "Z" base (for toe space).
- D. Provide sloped tops for lockers that are not recessed into the wall.
- E. Accessories: For each staff locker provide the following:
 - 1. Recessed stainless steel handle with embossed door pull and integral combination locks. The multi-tier 6 unit lockers shall be provided with standard padlocks.
 - 2. Spring latch with automatic engagement.
 - 3. Number plate.
 - 4. Two single-prong coat hooks on side walls of locker.
 - 5. Ventilation: Door perimeter.

2.05 LOCKER ACCESSORIES AND HARDWARE

- A. Hinges: Not less than 2 inches wide by 3 inches high full-loop, tight pin style, securely welded to the frame and riveted or bolted to the door with at least two (2) Phillips or clutch-head bolts for each hinge. Single tier locker doors shall have three (3) hinges each.
- B. Security Hardware: Provide recessed locking hasp and handle and integral combination lock.
 - 1. Latching Mechanism: Positive automatic latching mechanism whereby the door may be locked while open and then secured by closing. At least two (2) tamperproof latches shall engage as the door closes. Provide replaceable rubber silencers at all points of contact for quiet operation.
 - 2. Door Pull: Embossed door pull.
- C. Coat Hooks: Zinc-plated steel single-prong and double-prong hooks with ball points, permanently attached to body of locker and having no sharp edges to snag clothing. Bolts shall be cadmium plated.
- D. Number Plates: Aluminum number plate with black-filled number not less than ½ inch high. Securely attach plate with rivets and number as directed by Architect. Numbering sequence shall be as selected by Owner.

2.06 LOCKER FABRICATION

- A. Construction: Fabricate each locker as a unit, square, rigid, and without warp, with metal faces

flat and free of dents and distortion. Make all exposed metal edges safe to touch. Weld frame members together to form rigid, one-piece structure. Weld seams and other joints and connections. Grind exposed welds flush. Do not expose bolts or rivet heads on fronts of locker doors or frames.

- B. Frames: Fabricate of 16 gauge channels or 12 gauge angles, minimum, with continuous stop/strike formed on vertical members.
- C. Panels: Provide all top, filler, fascia, back and cover panels indicated on Drawings, as required to fill gaps between lockers and adjacent construction and to cover exposed sides and backs of lockers, in accordance with details shown. Make bends cleanly with straight, true arises, hemming or folding so as to leave no exposed single edges. Screws shall be concealed as far as possible. Sloping top panels shall be single sections in as long lengths as practicable. Do not use large mouldings or trim strips but follow details.

2.07 LOCKER FINISH

- A. General: Apply baked-on enamel finish to all surfaces, exposed and concealed, except number plates, stainless steel and non-ferrous metals.
- B. Pretreatment: All metal parts shall be degreased and treated prior to painting with an iron phosphate treatment applied by means of a metal spray washer.
- C. Finish Coat: Material shall then be finished with one (1) heavy coat of enamel baked on at 350 degrees F. After phosphate treatment and application of baked enamel, material shall withstand a minimum of 200 hour salt-spray test in accordance with ASTM B-117.
 - 1. Colors: Provide colors as selected by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION AND ACCEPTANCE

- A. Examine conditions where lockers are to be installed to determine that conditions are satisfactory for the installation of this equipment. Report in writing to the Architect any unsatisfactory conditions. Commencement of work shall constitute acceptance of conditions.
- B. Do not deliver metal lockers until building is enclosed and ready for locker installation. Protect from damage during delivery, handling, storage and installation.
- C. Prior to date of Substantial Completion, test operation of all locker doors and locking systems, and make all adjustments necessary to ensure completely trouble-free operation.
- D. Locker installer shall be responsible for any and all damage to surrounding receiving surfaces resulting from installation of metal locker units. Coordinate installation with other trades in order to minimize damage to surrounding surfaces.
- E. Coordinate layout of locker anchors with components of the structural system and with other trades. Provide drawings showing locations of all anchors to affected trades.

- F. Advise other trades about specific requirements relating to the placement of inserts, embeds, anchors and similar items used for anchoring the lockers.

3.02 INSTALLATION

- A. Install work in accordance with the approved Shop Drawings and the manufacturer's installation instructions.
- B. Furnish and install all tops, closure and filler pieces as required to completely fill recesses, and to align with ends of partitions. Refer to Drawings for the various conditions. Locker batteries shall have sloping tops where units are not recessed.
- C. Set lockers plumb, level and in true line, with units bolted together and to the base to provide a rigid and secure installation. Conceal screw heads and bolts as far as practicable, leaving exposed panels completely free from unused bolt holes.
- D. Install closure panels wherever ends of lockers are exposed to view.

3.03 INSTALLATION OF ANCHORS

- A. Provide all anchorage devices and fasteners necessary to anchor the lockers.
- B. Install all anchorage to the base building structure in accordance with approved Shop Drawings and fastener manufacturer's printed instructions.
- C. Install all anchorage to stud walls in accordance with approved details coordinated with stud locations.
- D. After installation, touch-up any field welds, field bolt heads, and nuts and any scarred surfaces on the base building structure.
- E. After installation, touch-up any galvanized members of the base building structure with an approved zinc-rich galvanized metal repair paint.

3.04 CLEAN UP

- A. Upon completion of installation, test, clean and touch up all units.
- B. Test each door, latch, and locking device, and make adjustments required to ensure a bind-free operation and proper latching and locking.
- C. Remove all tape and other packing material from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces of the units.
- D. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

END OF SECTION

SECTION 110610
STAGE RIGGING AND CURTAINS

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 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.3 SUMMARY

- A. Section Includes
 - 1. Motorized rigging system
 - 2. Dead-hung pipes
 - 3. Stage traveler track assemblies
 - 4. Pipe battens
 - 5. Electric batten cable management
 - 6. Acoustic ceiling panel
 - 7. Stage and studio curtains
 - 8. Accessories
- B. Product Installed But Not Supplied Under This Section:
 - 1. Electric batten connector strips
- C. Related Sections
 - 1. Section 11 06 40 – Theatrical Lighting Control and Fixtures
 - 2. Division 26

1.4 BID SUBMITTALS

- A. Qualifications
 - 1. Bidder shall be a system contractor, normally engaged in the full time business of rigging system installation. Provide evidence that the bidder has been in business for at least five years prior to bid date and has completed projects of similar size and scope.

2. References, including names and telephone numbers of individuals who may be contacted, showing satisfactory completion of five or more projects similar in scope and type to that specified herein.
 3. Evidence of ability and affirmation of intent to meet the guarantee and service requirements stated herein.
 4. Each vendor shall include a description of the professional and technical experiences background, qualifications and expertise of the organization's key personnel assigned to this project. The description shall show that bidder possesses the demonstrated skills and experience in specific areas of the project scope. In addition, Bidder shall identify a project manager for the project and shall provide resumes of all personnel who shall be assigned to this project. Bidder shall estimate the percentage of time each individual shall be working on this project.
- B. Alternates
1. With system bid price, submit prices for equipment and installation of additional or reduced quantities of equipment as stated herein. Unless otherwise stated, all items herein are part of the base bid system.
 2. Deduct/Alternate
 - a. Provide price to delete single general purpose line set.
- C. Substitutions
1. Any request for a substitution for a specified product or material must be made, in writing, to the Architect. Such requests must not impact the project schedule.
 2. Substitution requests will only be accepted if the Architect deems the product or materials to be an equal to the specified product. No substitutions may be made without written authorization from the Architect.
 3. Any and all additional expenses incurred as a result of a requested substitution shall be borne solely by the Contractor. These expenses may include, but not be limited to, all fees and expenses incurred by the Architect in evaluating the substitution and additional costs to other contractors incurred by the substitution.
- 1.5 DEFINITIONS
- A. Furnish – Purchase and/or fabricate the item and deliver to site.
 - B. Install – Perform the physical installation of the item on the site.
 - C. Provide – Furnish and install item or items, complete with any and all required accessories.
- 1.6 SYSTEM DESCRIPTION
- A. Auditorium
1. Motorized rigging system.
 2. Stage travelers, track and accessories.
 3. Masking drapery.
 4. Cable management accessories.
- 1.7 SUBMITTALS
- A. Provide submittals in accordance with requirements of Section 013300 - Submittals.
 - B. Product Data
 1. Submit manufacturer's product data for standard hardware including wire rope compression sleeves, turnbuckles, shackles and wire rope.
 - C. Shop Drawings

1. Shop drawings shall be submitted in an expeditious manner. The timing of the submittal shall allow sufficient time for review, revision and resubmittal without impacting the project schedule.
 2. Shop drawing sheet size shall be uniform with a minimum size of 24" x 36"
 3. Shop drawings shall include the following
 - a. 1/4"=1'-0" scale plans and elevations including locations of electrical and control system components
 - b. Electrical riser and wire termination diagrams
 - c. Assembly drawings of all major components including weights, dimensions and finishes.
 - d. Calculations of weight and loading bearing capacity of individual components and the full system. Indicate ultimate breaking strength and safety factor for all rigging components.
 - e. Component and installation drawings and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation.
 - f. All rigging drawings shall be stamped by a licensed professional engineer. The engineer shall verify that the equipment supplied under this section meets or exceeds the design criteria set forth in this specification and on the Drawings.
 - g. Space for review stamps and comments.
 - h. Complete list of all draperies indicating material, fullness, color, size and finishing details.
 - i. 24 inch by 24 inch swatch of each fabric in the system.
 4. Approval of the shop drawings does not relieve the Rigging Contractor of the responsibility of providing equipment in accordance with the specifications.
- D. Quality Assurance/Control
1. Verify wire type, conduit size, and power requirements for all electrified elements in system.
- E. Closeout Submittals
1. Submit documents in accordance with Division 1.
 2. Within 45 days of acceptance testing, submit the following:
 - a. One set of reproducible as-built drawings. These drawings shall include all adjustments made during the installation and acceptance testing processes.
 - b. Upon completion of commissioning, the Contractor shall submit 3 copies of a detailed Operating and Maintenance Manual including as-built shop drawings, equipment descriptions, and parts lists. The Contractor shall go through the manual with personnel designated by the owner to demonstrate and explain the maintenance and operation of the systems.
 - c. Draperies:
 - 1) Cleaning instructions.
 - 2) Compiled list of all periodic maintenance required for all components of the system.
 - 3) Original signed and notarized certificates with each fabric used affirming the fabrics satisfy all applicable codes.
- 1.8 QUALITY ASSURANCE
- A. Qualifications
1. The Contractor shall have a valid Contractor's License at the time of bid and throughout the project.
- B. Pre-Installation Meetings
1. Attend coordination meetings as required to ensure installation is coordinated with other trades.
- C. All draperies shall be the fabricated by a single theatrical drapery contractor.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packing, Shipping, Handling, and Unloading
 - 1. All shipping and trucking costs are the responsibility of the Contractor. Method of shipment is at the discretion of the Contractor.
- B. Acceptance at Site
 - 1. Coordinate delivery and acceptance with the Construction Manager.
- C. Storage and Protections
 - 1. Protect all equipment from damage and deterioration during all phases of work.

1.10 PROJECT CONDITIONS

- A. Existing Conditions
 - 1. Verify all existing conditions and dimensions at the project site prior to preparing submittal drawings.
 - 2. Verify final drapery dimensions in field prior to fabrication.

1.11 WARRANTY

- A. The Rigging Contractor shall provide a two year written guarantee against defects in materials or workmanship. The warranty period shall start from the date of acceptance of the work by the Owner's Designated Representative. Any required maintenance or replacement shall be provided by the Contractor within fifteen days of notification by the Owner, except for safety related items, which shall be corrected within 48 hours of notification.

1.12 COMMISSIONING

- A. Upon completion of the work, notify the Architect in writing that the system is ready for commissioning.
- B. During commissioning the Owner's Designated Representative will verify that system operation is per specifications. Provide a representative on-site to assist in the commissioning of the system and fix minor problems as they are discovered.

1.13 OWNER'S INSTRUCTION

- A. Provide in-depth training of the user's staff in the operation of system.
- B. All training shall be performed by the staff of Contractor.
- C. Signage with basic operating instructions and warnings shall be posted in the area where the equipment will be operated. Signage shall be in conformance with ANSI-Z535.

1.14 MAINTENANCE

- A. Extra Materials
 - 1. Provide maintenance materials to the Owner as required for routine maintenance of system and components for two years.
- B. Maintenance Services
 - 1. One year after acceptance testing a technician shall return to the project site to inspect, adjust and repair the system. All labor and materials required to perform this service shall conform to these specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Equipment Manufacturers
 - 1. J.R. Clancy
 - 2. H&H Specialty
 - 3. Texas Scenic
 - 4. Secoa
 - 5. Pook, Deimont and Ohl
- B. Drapery Manufacturers
 - 1. Stage Decoration and Supply
 - 2. Rosebrand
 - 3. Major Theatre Equipment

2.2 MATERIALS

- A. Materials shall conform to the following ASTM and ANSI standard specifications:
 - 1. A-36 -Specification for structural steel
 - 2. B18.2.1&2 - Specification for square and hex bolts and nuts
 - 3. B 106.1M – Design of Transmission Shafting
 - 4. B 17.1 – Keys and Keyseats
- B. All overhead rigging elements including but not limited to mounting hardware, wire rope, wire rope fittings, and shackles to be designed to a safety factor of 10 times their rated breaking strength.
- C. Cable Fittings:
 - 1. Cable clips shall conform to wire rope manufacturer's recommendations as to size, number, and method of installation. Clips shall be drop forged "Crosby" or approved equal. Under no circumstances may malleable cable clips be used in suspension or lifting lines.
 - 2. Swaged sleeve fittings shall be copper "Nicopress" or equal. Swaged fittings shall be installed per the fitting manufacturer's instructions, using the appropriate tools, and checked with a "Go - No go" gauge.
 - 3. Eyes shall be formed over galvanized wire rope thimbles of correct sizes.
- D. All turnbuckles and shackles shall be drop forged and galvanized.
- E. Draperies
 - 1. Provide vat-dyed fabrics that are inherently flame-resistant or fully flame retardant in accordance with NFPA 701 (1999) and the International Building Code.

2.3 FABRICATION

- A. Fabrication Tolerances
 - 1. The mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. There shall be no burrs or sharp edges to cause a hazard or any sharp corners accessible to personnel.
 - 2. All equipment shall be built and installed to facilitate future maintenance and replacement.
- B. Drapery
 - 1. Provide all fabric cuts with full length; no splices.
 - 2. Provide draperies with sewn fullness and fabric types as indicated in the Drapery Schedule.
 - 3. Remove all drapery fabric from bolts and inspect on illuminated (100 foot-candle minimum) table for flaws and imperfections. Cut out flawed section prior to sewing final product.

4. Provide all draperies with heavy-duty polyester webbing with a minimum weight of 2.8 oz per yard, double stitched as the top 2-3/4 inches apart and having machine set black anodized grommets on one foot centers.
5. Floor length draperies will have a six (6) inch bottom hem with suspended inner pocket containing #8 zinc coated chain weight. Lead tape, or any other toxic substances, shall not be incorporated into any product in this section. Leading hems of traveler curtains will use one-half width turnback. All other side hems will be two (2) inches.
6. All linings (where applicable) for draperies shall be attached to the face material by adjustable black hook-and-loop tape (one inch wide) and approximately 10" long, in two 5" sections arranged to be concealed from the face side. Tape sections are to be located at approximately 36" spacing along the bottom and 24" at the sides. Attach tapes to edge of vertical facebacks and top of bottom hem with mates attached to edge of lining.
7. Provide drapery lining with the same fullness as the face fabric and finish 2" shorter than the face fabric. Sew 10 inch bottom hem of lining to allow for shrinkage.
8. All draperies operating from traveler tracks shall have oblong spring, carabiner type snaps for each grommet location. All other draperies shall have black No. 4, 36" tie lines, knotted and tied.
9. Prior to sewing the bottom hem, the otherwise completed drapery sections shall be hung full height to their finished width and allowed to hang untouched for two weeks (minimum) after which the bottom shall be scribed and hemmed to the specified finished height. Scrims/Cycloramas shall have a pipe pocket in bottom hem. Scrims shall be finished at the top per above instructions and the bottom hem shall be six inches wide with an inner pocket pipe pocket.

2.4 FINISHES

- A. Clean structural steel and fabricated steelwork of rust, scale and foreign matter by grinding. Finish steel with 1 coat of primer and 1 coat of enamel. Final finish shall be free of skips and runs. Touch up all field connections, welds and abraded areas after installation with primer and enamel.
- B. All painted finished to be low-sheen black unless otherwise noted.

2.5 MOTORIZED HOISTS

- A. General
 1. Provide hoists manufactured and installed with the following safety factors:
 - a. Cables and fittings: 10:1
 - b. Maximum fleet angle: 1-1/2 degrees
 - c. Steel: 5:1 from yield
 - d. Bearings: Two times required load at full speed for 2000 hours.
 2. Mechanical fabrication and workmanship shall incorporate best practices for good fit and finish. Remove all burrs or sharp edges that might cause a hazard to user or equipment.
 3. Provide each hoist equipped with:
 - a. Load sensing device
 - b. Limit switches with hard-struck limits for normal and of travel and overtravel.
 - c. Dual over-speed brake: spring applied, electrically released; capable of holding 150% of full load torque.
 - d. Slack line detector
 - e. Positional encoders
 - f. Pipe batten
 - 1) Pipe batten shall be 1.5-inch nominal pipe thread schedule 40 pipe.
 - 2) Joints shall be internally sleeved with 18-inch long pipe and two bolts on either side of joint.
 - 3) Paint flat black.

- 4) Provide safety-yellow vinyl end cap at each end of pipe batten.

- B. General Purpose Batten Hoist
 1. Batten payload capacity: per Drawings
 2. Speed: 30 feet per minute
 - a. Electronic Theatre Control Prodigy G Series
 - b. Vortek equal
 - c. JR Clancy equal
 - d. Stage Technologies equal
 - 1) Quantity: per Drawings
- C. Variable Speed Batten Hoist
 1. Batten payload capacity: per Drawings
 2. Speed: 180 feet per minute
 - a. Electronic Theatre Control V1000S
 - b. Vortek equal
 - c. JR Clancy equal
 - d. Stage Technologies equal
 - 1) Quantity: per Drawings
- D. Electric Batten Hoist
 1. Batten payload capacity: per Drawings
 2. Speed: 30 feet per minute
 3. Integral cable management
 4. Connector strip: length and connectors per Drawings
 - a. Electronic Theatre Controls P1500E
 - b. Vortek equal
 - c. JR Clancy equal
 - d. Stage Technologies equal
 - 1) Quantity: per Drawings

2.6 MOTORIZED HOIST CONTROL

- A. General
 1. Provide wall-mounted main control station with:
 - a. Color multi-touch flat panel display
 - b. Convection cooled (no fans)
 - c. Programmable cues
 - d. Cue speed override capability
 - e. Two "Go" buttons
 - f. Key-switch
 - g. Display with feedback and hoist operating information including:
 - 1) Hoist name and number
 - 2) Hoist position relative to floor
 - 3) Load attached to batten
 - 4) Indication of what will move in next cue
 - h. Hold-to-operate up/down buttons
 - i. E-stop button
 - j. Wired remote control
 - k. Locking door
- B. Operation
 1. Up to four hoists shall be selectable for operation at one time.

- C. Emergency Stop Button Stations
 - 1. Provide E-stop button stations per drawings.
 - 2. Wire to main controller.
- D. Product
 - 1. Electronic Theatre Foundation Rigging Controller
 - 2. Vortek equal
 - 3. JR Clancy equal
 - 4. Stage Technologies equal

2.7 DEAD-HUNG BATTEN

- A. Beam Clamp
 - 1. Provide beam clamp with two 7-gauge painted steel plates with cut-out as required to grasp beam flange.
 - 2. Provide beam clamp with 1/4" round pin anchor shackle for attachment to support line.
 - 3. Verify size of support steel in field before ordering beam clamp.
- B. Support Line
 - 1. Provide 1/4" 7x19 galvanized wire rope
 - 2. Minimum ultimate break strength: 7,000 pounds
 - 3. Connect to pipe batten using copper compression sleeve, wire rope thimble, 24" length of 1/4" Grade 30 proof coil chain, and forged round pin shackle with cotter pin.
- C. Batten
 - 1. Material: 1-1/2 inch nominal pipe thread (NPT) schedule 40 steel pipe.
 - 2. Sleeve: 18 inch long sleeve equally spaced around joined with two 3/8 inch hex head bolts and locking nuts perpendicular to each other on each side of joint.
 - 3. Finish: flat black enamel
 - 4. Ends: cover with brightly colored, closed end vinyl cap. Minimum length: 4 inches.
 - 5. Center mark: 1 inch wide yellow stripe on stage centerline

2.8 ELECTRIC BATTEN CABLE MANAGEMENT

- A. Provide pantograph-style cable management device to guide all power and data wiring as the batten is lowered and raised.
- B. Provide pantograph assembly shall be made of light weight extruded aluminum wireway (in cross section containing five cable compartments) built in sections hinged at each end so that as the batten lowers the sections extend out keeping the cable captive within the aluminum sections.
- C. The pantograph assembly shall attach rigidly to the batten between lift points with manufacturer's clamps, and shall be supported at the top by a dynamic point to allow for horizontal stabilization. The dynamic point shall consist of a section of double-backed P1001 Unistrut-type track that is rigidly connected to building structure, and a P2950 trolley/carrier which allows this point to move side to side as the batten is raised.
- D. Flat multi-conductor "festoon" SO cable shall be used for 120-v circuits, 8 conductors per cable. These cables shall be 90 degree C stranded with UL listing for use as flexible extra-hard usage flat cable. Provide gland-type strain relief compression grips, on all junction boxes for the electrical cable
- E. Provide a UL listed 16 gauge steel junction box for field interconnection of conductors. Locate junction boxes at the top and bottom of pantograph assembly to receive wiring from building conduits and to distribute out to loads. Screw clamp terminals will be rail mounted and will

accommodate up to #8 AWG wire for 20 amp circuits. Provide ground lugs as required. All control and low voltage circuits will be terminated in a separate NEMA rated junction box with appropriately sized screw clamp type terminals.

- F. Each section shall contain electrically insulated adjustable pressure pad strain relief devices to hold all cables securely in place.
- G. Pantograph assembly shall be inherently rust proof with an electrostatic paint finish in black.

2.9 STAGE TRAVELER TRACK ASSEMBLY

- A. Provide bi-parting line-operated curtain track per Drawings for stage travelers.
- B. Support traveler track with dead-hung line set.
- C. Track
 - 1. Material: 14 gauge 3 inch by 3 inch steel channel
 - 2. Color: black
 - 3. Hanger: clamp to pipe batten
 - 4. Hanger spacing: 6 feet on center
 - 5. Center overlap: 3 feet
- D. Carriers
 - 1. Master carrier: one per traveler panel, each with four pairs of neoprene wheels attached to steel support plate.
 - 2. Single Carrier: Two heavy-duty neoprene wheels on ball-bearing attached to steel support plate.
 - 3. Trim chain: 4 inch long, attached to all carriers
 - 4. Provide back pack guide for all carriers.
- E. Pulley Blocks
 - 1. Dead end pulley: 8 inch diameter Nylatron sheave on ball bearing.
 - 2. Live end pulley: two 8 inch diameter Nylatron sheaves on ball bearings.
 - 3. Floor Pulley: 8 inch diameter Nylatron sheave on ball bearing with eight inches of height adjustment.
- F. Operating Line
 - 1. Material: ½ inch diameter braided black cotton cord with synthetic center in single, unspliced length.
- G. Product
 - 1. Automatic Devices Company Series 380 cord-operated bi-part curtain track
 - 2. H&H Specialties equal

2.10 PIPE BATTENS

- A. Batten
 - 1. Material: 1-1/2 inch nominal pipe thread (NPT) schedule 40 steel pipe.
 - 2. Sleeve: 24 inch long sleeve equally spaced around joined with two 3/8 inch hex head bolts and locking nuts perpendicular to each other on each side of joint.
 - 3. Finish: flat black enamel
 - 4. Ends: cover with brightly colored, closed end vinyl cap. Minimum length: 4 inches.
 - 5. Center mark: 1 inch wide yellow stripe on stage centerline
- B. General Purpose Batten Lift Line Attachment
 - 1. Trim chain: 36 inch long ¼ inch grade 30 proof coil chain with copper compression fitting and thimble at cable attachment. Wrap chain one and a half times around pipe batten and attached to thimble with ¼ inch forged cotter-pin shackle.
 - 2. Provide 3/8 inch diameter bolt, locking nut and washers. Secure trim chain after batten is leveled.

3. Trim chain working load limit: 700 pounds

2.11 ACOUSTIC CEILING PANEL

A. General

1. Acoustical shell ceiling consisting of adjustable-angle acoustical shell ceiling panels, suspended from stage rigging pipe batten, and stored in fly-loft in vertical position.

B. Materials

1. Core: $\frac{3}{4}$ inch thick honeycomb, resin impregnated, bonded to frame and faces with permanent urethane adhesive.
2. Face: $\frac{3}{16}$ thick hardboard with plastic laminate woodgrain finish selected from full line of manufacturer's available patterns.
3. Back: $\frac{3}{16}$ inch thick hardboard, painted black
4. Edge frame: extruded aluminum edge angle, along straight edges.
5. Panel hinges: self-lubricating ABS bushings and steel framework.

C. Size: per Drawings

D. Radius: 10 feet

E. Basis of Design

1. Wenger Forte Acoustical Shell
2. Equal
 - a. Quantity: 2

2.12 DRAPERIES

A. Main Valance

1. Material
 - a. 26 ounce IFR velour
 - b. 45 backing ends per inch
 - c. 51 pile ends per inch
 - d. 48 picks per inch
 - e. 1148 pile tufts per square inch
 - f. 120/1000 inch pile height
 - g. Acceptable Products
 - 1) K-M Fabrics "Prestige"
 - 2) Equals by JB Martin, Gerriets or DeBall
2. Color: Selected from the approved manufacturer's complete selection of standard colors.
3. Hems: 4 inch side hems
4. Lining: Black IFR Avora
5. Fullness: Box pleats one foot on center, per Drapery Schedule
6. Top Finish: Grommets and 36 inch knotted black tie lines on one foot centers
7. Bottom Finish: 6 inch muslin chain pocket with #8 chain.

B. Main Traveler

1. Material
 - a. 26 ounce IFR velour
 - b. 45 backing ends per inch
 - c. 51 pile ends per inch
 - d. 48 picks per inch
 - e. 1148 pile tufts per square inch
 - f. 120/1000 inch pile height
 - g. Acceptable Products
 - 1) K-M Fabrics "Prestige"
 - 2) Equals by JB Martin, Gerriets or DeBall
2. Color: Selected from the approved manufacturer's complete selection of standard colors.

3. Hems
 - a. Offstage: 4 inch
 - b. Onstage: Half of width of fabric
 4. Lining Black IFR Avora
 5. Fullness: Box pleats one foot on center, per Drapery Schedule
 6. Top Finish: Grommets and oblong spring-closure carabineer on one foot centers
 7. Bottom Finish: 6 inch muslin chain pocket with #8 chain.
- C. Leg
1. Material
 - a. 20 ounce IFR velour
 - b. 65 backing ends per inch
 - c. 51 pile ends per inch
 - d. 51 picks per inch
 - e. 1658 pile tufts per square inch
 - f. 130/1000 inch pile height
 - g. Acceptable Products
 - 1) K-M Fabrics "Crescent"
 - 2) Equals by JB Martin, Gerriets or DeBall
 2. Color: Black
 3. Hems: 4 inch side hems
 4. Lining: None
 5. Fullness: Box pleats one foot on center, per Drapery Schedule
 6. Top Finish: Grommets and 36 inch knotted black tie lines on one foot centers
 7. Bottom Finish: 6 inch muslin chain pocket with #8 chain.
- D. Border
1. Material
 - a. 20 ounce IFR velour
 - b. 65 backing ends per inch
 - c. 51 pile ends per inch
 - d. 51 picks per inch
 - e. 1658 pile tufts per square inch
 - f. 130/1000 inch pile height
 - g. Acceptable Products
 - 1) K-M Fabrics "Crescent"
 - 2) Equals by JB Martin, Gerriets or DeBall
 2. Color: Black
 3. Hems: 4 inch side hems
 4. Lining: None
 5. Fullness: Box pleats one foot on center, per Drapery Schedule
 6. Top Finish: Grommets and 36 inch knotted black tie lines on one foot centers
 7. Bottom Finish: 6 inch muslin chain pocket with #8 chain.
- E. Traveler
1. Material
 - a. 20 ounce IFR velour
 - b. 65 backing ends per inch
 - c. 51 pile ends per inch
 - d. 51 picks per inch
 - e. 1658 pile tufts per square inch
 - f. 130/1000 inch pile height
 - g. Acceptable Products
 - 1) K-M Fabrics "Crescent"
 - 2) Equals by JB Martin, Gerriets or DeBall
 2. Color: Black

3. Hems
 - a. Offstage: 4 inch
 - b. Onstage: Half of width of fabric
 4. Fullness: Box pleats one foot on center, per Drapery Schedule
 5. Lining: None
 6. Top Finish Grommets and oblong spring-closure carabineer on one foot centers
 7. Bottom Finish: 6 inch muslin chain pocket with #8 chain.
- F. Scrim
1. Material: seamless flame-retardant sharktooth scrim
 2. Color: Black
 3. Hems: 3 inch side hems
 4. Lining: None
 5. Top Finish: Grommets and 36 inch knotted black tie lines on one foot centers
 6. Bottom Finish: 6 inch muslin pipe pocket behind bottom hem.
- G. Cyclorama
1. Material: 12 foot wide bleached flame-retardant muslin
 2. Seams: sewn horizontally
 3. Color: White
 4. Hems: 3 inch side hems
 5. Lining: None
 6. Top Finish: Grommets and 36 inch knotted black tie lines on one foot centers
 7. Bottom Finish: 6 inch muslin pipe pocket behind bottom hem.

2.13 DRAPERY SCHEDULE

Description	Qty	Height	Width	Fullness	Notes
Main Valance	1	8'-0"	60'-0"	100%	Lined, Color TBD
Main Curtain	2	22'-0"	31'-6"	100%	Lined, Color TBD
Leg	8	22'-0"	9'-0"	Flat	Black
Border	4	8'-0"	64'-0"	Flat	Black
Side Masking	6	22'-0"	10'-0"	Flat	Black
Scrim	1	22'-0"	60'-0"	Flat	Black
Cyclorama	1	22'-0"	60'-0"	Flat	White

2.14 PIPE WEIGHT

- A. Provide one inch nominal NPT pipe with threaded ends and coupling for full width of draperies with pipe pocket bottoms.
- B. Clean and paint fittings and pipe black.

2.15 STORAGE HAMPER

- A. Provide sixteen-bushel canvas storage hamper with steel frame, heavy-duty castors and hinged plywood top.
 1. Steele Canvas Model 82
 2. Equal
- B. Quantity: 4

PART 3 - EXECUTION

3.1 INSTALLERS

- A. Only qualified personnel shall install the equipment in this Section.

3.2 EXAMINATION

A. Site Verification of Conditions

1. The Contractor shall examine areas and conditions under which the equipment is to be installed and shall notify the Owner's Designated Representative in writing of conditions detrimental to the proper and timely completion of the work. If unsatisfactory conditions are present, do not proceed with work until they have been corrected.

3.3 INSTALLATION

- A. The Contractor shall be responsible for storage of stage equipment, tools, and equipment during the period of the installation.
- B. Extent: All specified equipment shall be installed by fully trained superintendents and workmen. Equipment shall be installed in a workman like manner, per plans and specifications. Equipment shall be aligned, adjusted, and trimmed for the most efficient operation, the greatest safety and for the best visual appearance.
- C. Standards: Installation practices shall be in accordance with OSHA Safety and Health Standards and all local codes. All welding must be performed in full compliance with the latest edition of the Structural Welding Code (ANSI/AWS D1.1).
- D. Alignment: Mule blocks, cable rollers and guides shall be installed, as required, to provide proper alignment, to maintain specified fleet angles, and to prevent contact with other surfaces.
- E. Attachments: All equipment shall be securely attached to the building structure. Underhung blocks and mule blocks shall be welded in place unless otherwise directed.
- F. Secure ("mouse") all turnbuckles with bailing wire after adjustment.
- G. Finishes:
 - 1. All welds must be touched up to match disturbed finishes.
 - 2. All finishes which are disturbed during shipping and installation shall be touched up to match the original.
- H. Drapery
 - 1. All materials to be flame-proofed to conform to local code.
 - 2. Allow all draperies to hang in place for 48 hours prior to inspection.
 - 3. Install drapery after stage house is fully climate controlled. Do not install draperies if there is a planned prolonged shut-down of the stage or auditorium climate control system before substantial completion.

3.4 FIELD QUALITY CONTROL

- A. Site Tests, Inspection
 - 1. Inspect all equipment for defects prior to installation.
 - 2. Upon completion of installation and wiring, test all system functions for complete operation.

3.5 CLEANING

- A. Touch up scratches as required.
- B. The Contractor shall be responsible for clean-up, including removal of all packing materials and the protection of surfaces and equipment provided by other contractors.

3.6 INSPECTION AND TESTING

- A. Inspection: During the installation of equipment the Contractor shall arrange for access as necessary for inspection of equipment by the Owner's Designated Representatives.

- B. System Inspection & Pre-Testing: On completion of installation and testing the Contractor shall conduct a complete pre-test of the system to ensure it is working properly and in conformance with this specification. This shall include a complete test of all electrical systems and components. All tests shall be conducted as if the Architect or Consultant were present and appropriate corrections made before the final inspection. Inspection shall be done using the rigging equipment manufacturer's written inspection forms.

3.7 DEMONSTRATION

- A. Upon system substantial completion, notify Architect, in writing, that system is ready for demonstration and inspection.
- B. Demonstrate operation of installed equipment for approval by the Architect and Owner.
- C. Make adjustments and modifications to the system as directed by the Architect and/or Owner.
- D. The cost of re-inspection and additional testing by the Architect, if required, due to lack of system completion and/or errors and omissions shall be borne by the Contractor or the Construction Manager, depending on the area of work in question. Additional inspections and testing will be carried out on a time and expenses basis with standard hourly billing rates.

3.8 FOLLOW-UP INSPECTION

- A. One year after the completion of installation, the return to the site and provide the following services:
 - 1. Complete inspection of the rigging system.
 - 2. Make all required adjustments.
 - 3. Correct all warranty items.
 - 4. Provide written recommendations for necessary repairs or changes not included in the warranty.
 - 5. Conduct a 1 hour rigging operation and safety class.
 - 6. Provide a written proposal for the next year's maintenance visit.

END OF SECTION

SECTION 110640
THEATRICAL LIGHTING CONTROLS AND FIXTURES

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 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.3 SUMMARY

- A. The work of this section includes all labor, materials, equipment and services required for the manufacture, delivery, coordination and installation of performance lighting dimming, control and distribution systems as indicated on the Drawings and schedules.
- B. Section Includes
 - 1. Engineering, manufacture, furnishing, coordination and commissioning of performance lighting dimming and control system including, but not limited to, the following:
 - a. Remote-controlled panel boards
 - b. Distribution faceplates and devices
 - c. Control faceplates and devices
 - d. Control console and accessories
 - e. System accessories
 - f. Lighting fixtures
 - g. Configuration of system
 - h. User training
- C. Products Controlled but not Provided Under This Section
 - 1. Architectural Lighting Fixtures
- D. Products Supplied But Not Installed Under This Section
 - 1. Products installed by the Electrical Contractor
 - a. Panel boards

THEATRICAL LIGHTING CONTROLS AND FIXTURES

- b. Switched power distribution including connectors strips and faceplates
- 2. Product not requiring installation
 - a. Lighting fixtures and accessories

1.4 RELATED WORK SPECIFIED ELSEWHERE

- A. Carefully examine all of the Contract Documents for requirements which affect the Work of this Section.
- B. Other Specification Sections which directly relate to the Work of this Section include, but are not limited to, the following:
 - 1. Section 01 00 00 - General Requirements
 - 2. Section 04 20 00 - Unit Masonry
 - 3. Section 06 20 00 - Finish Carpentry and Millwork
 - 4. Section 07 84 13 - Penetration Firestopping
 - 5. Section 09 22 16 - Non-Structural Metal Framing and Gypsum Board
 - 6. Section 26 00 00 – Electrical
 - a. Reference Division of responsibility matrix.
 - 7. Section 27 41 16 – Integrated Audiovisual Systems
 - 8. DIVISION 27 - Communications; including all Sections contained therein

1.5 REFERENCES

- A. National Fire Protection Association (NFPA)
 - 1. NFPA70 - National Electrical Code
 - 2. NFPA 110 – Standard for Emergency and Standby Power Systems
- B. American National Standards Institute (ANSI)
 - 1. E1.11-2004 - USITT DMX512-A
 - 2. E1.17-2006, Entertainment Technology – Multipurpose Network Control Protocol Suite (ACN)
 - 3. E1.20-2006, Entertainment Technology – Remote Device Management over USITT DMX512
 - 4. E1.27-1-2006, Entertainment Technology – Standard for Portable Control Cables for Use with ISUTT DMX512/1990 and E1.11 Products
- C. Institute of Electrical and Electronics Engineers (IEEE)
 - 1. 802.3 – Ethernet
 - 2. 802.11 – Wireless LAN
- D. Underwriters Laboratories (UL)
 - 1. 498 – Attachment Plugs and Receptacles
 - 2. 891 - Switchboards
 - 3. 924 – Emergency Lighting and Power Equipment
 - 4. 1008 – Transfer Switch Equipment

1.6 BID SUBMITTALS

- A. Qualifications
 - 1. Manufacturer shall have been continuously engaged in the design and manufacture of performing lighting dimming and control equipment for at least ten (10) years.
 - 2. Bidder shall be a system contractor, normally engaged in the full time business of lighting system installation. Provide evidence that the bidder has been in business for at least five years prior to bid date and has completed projects of similar size and scope.

3. References, including names and telephone numbers of individuals who may be contacted, showing satisfactory completion of five or more projects similar in scope and type to that specified herein.
 4. Evidence of ability and affirmation of intent to meet the guarantee and service requirements stated herein.
 5. Each vendor shall include a description of the professional and technical experiences background, qualifications and expertise of the organization's key personnel assigned to this project. The description shall show that bidder possesses the demonstrated skills and experience in specific areas of the project scope. In addition, Bidder shall identify a project manager for the project and shall provide resumes of all personnel who shall be assigned to this project. Bidder shall estimate the percentage of time each individual shall be working on this project.
- B. Alternates
1. With system bid price, submit prices for equipment and installation of additional or reduced quantities of equipment as stated herein. Unless otherwise stated, all items herein are part of the base bid system.
- C. Unit Pricing
1. Provide unit pricing to provide additional quantity of items as specified.

1.7 DEFINITIONS

- A. Furnish – Purchase and/or fabricate the item and deliver to site.
- B. Install – Perform the physical installation of the item on the site.
- C. Provide – Furnish and install item or items, complete with any and all required accessories.

1.8 SUBMITTALS

- A. Provide submittals in accordance with requirements of Section 013300 - Submittals.
- B. Product Data
 1. Submit complete Bill of Materials including spare parts, quantities, manufacturer and model numbers.
 2. Submit manufacturer's catalog cut sheets for all products used in the system.
- C. Shop Drawings
 1. Submit 11" x 17" sheets. All sheets shall be the same size. Include title sheet listing all drawings in the submittal.
 2. Show all assembly instructions, termination details, cable numbers and other information required to ensure proper installation of the equipment.
 3. Show all materials, finishes, metal gauges, dimensional information, electrical and mechanical connections, provision for work by others and related information.
 4. Provide drawings showing wiring, addressing and termination scheme for architectural lighting fixtures.
 5. Indicate deviations from this Specification and label with minimum 1/4" high text: "Variation from Spec."
 6. Revise drawings with changes marked on the reviewed submittal and any changes made during manufacturing or due to coordination with other trades. Send a revised shop drawing to Architect at the time of the first delivery of equipment.
 7. Installation of equipment shall not begin until shop drawings have been approved by the Architect.
- D. Quality Assurance/Control

THEATRICAL LIGHTING CONTROLS AND FIXTURES

1. Submittals
 - a. Verify wire type, count and routing for all low-voltage wiring between components.
 - b. Confirm conduit sizes and routing within 30 days of contract award.
 2. Test Reports
 - a. Prior to scheduling a final checkout the Manufacturer's field technician shall submit to the Architect a letter stating that the system has been installed correctly is fully operational.
 - E. Closeout Submittals
 1. Prepare and submit complete Operations and Maintenance Manuals in accordance with the requirements in Division 1.
 2. Submit one (1) bound set to the Architect for review. Make revisions as directed by the Architect and submit revised manual as follows:
 - a. Three (3) bound sets to the Owner
 - b. One (1) bound set to the Architect.
 3. Operations and Maintenance Manual shall contain:
 - a. As-built shop drawings showing all systems, interconnections and components as installed.
 - b. Operating instructions for all equipment
 - c. Compiled list of all periodic maintenance required for all components of the system
 - d. Printed copy of initial system configuration
 - e. Warranty information
 - f. Emergency and regular technical support telephone contact information.
 - g. CD or DVD with all applicable software, system configuration information and maintenance and instruction manuals
- 1.9 QUALITY ASSURANCE
- A. All work and materials in this section shall comply with the following:
 1. National Electrical Code NFPA 70
 2. Applicable state and local construction codes
 3. Tested by a Nationally Recognized Testing Laboratory such as UL or ETL.
 - B. Pre-installation Meetings
 1. Attend coordination meetings as required to ensure installation is coordinated with other trades.
- 1.10 DELIVERY, STORAGE, AND HANDLING
- A. Delivery, storage and handling shall be coordinated with the Electrical Contractor and meet all the requirements set forth in Division 1.
 - B. Packing, Shipping, Handling, and Unloading
 1. Securely package all equipment in factory fabricated wooden or cardboard containers for delivery.
 2. Package and handle all equipment to prevent breakage, denting and scratching of finishes. Damaged equipment shall not be installed. Replace with new units from manufacturer.
 - C. Storage and Protections
 1. Store all equipment in a substantially complete, "broom clean", secure and conditioned space.
 2. Store all equipment in its original packaging until installation.

1.11 WARRANTY

- A. Warrant systems and equipment to be free from defective components, faulty workmanship and improper adjustment for two (2) years from the date of Owner's final acceptance of system.
- B. During the warranty period repair or replace defective items within ten business days of the defect being reported. If temporary replacement equipment is required it shall be provided to the Owner at no cost.
- C. Correct conditions that could present a safety hazard within forty-eight hours of notification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following are the acceptable manufacturers for the primary dimming and control components of the system:
 - 1. Electronic Theatre Controls (ETC)
3031 Pleasant View Road
Middleton, WI 53562
800.688.4116
www.etconnect.com
 - 2. Strand Lighting
6603 Darin Way
Cypress, CA 90630
714.230.8200
www.strandlighting.com

2.2 CONTROL WIRE

- A. Provide all control wiring per manufacturer requirements.
- B. Architectural Control Station
 - 1. Electronic Theatre Controls
 - a. Belden 8471, One #14 AWG stranded, Two #16 AWG
 - 2. Strand
 - a. Belden 1583A, Two #14 AWG stranded
- C. Ethernet
 - 1. Belden 1583A
 - 2. Equal
- D. DMX
 - 1. Belden 9729
 - 2. Equal

2.3 MOTORIZED CIRCUIT BREAKER PANEL

- A. General
 - 1. Provide Ethernet-controlled AC switching panel with individual circuit over-current protection.
- B. Control
 - 1. Control: Single universe of DMX over Ethernet
 - 2. Provide panel with contact-closed triggered emergency override scene recall.

3. 0-10V output for control of architectural fixtures.

- C. Electrical
 - 1. Provide with 20A circuit breakers.
 - 2. Provide with main breaker to match electrical input shown on Drawings.
 - 3. Provide panel with 100% neutral capacity.
- D. Provide
 - 1. ETC Sensor IQ
 - 2. Strand equal

2.4 ARCHITECTURAL LIGHTING PROCESSOR

- A. Provide unit designed for operation with supplied dimmer racks.
- B. Provide unit with Ethernet connection to the lighting control network for configuration and control.
- C. Provide unit capable of backing up settings to removable media.
- D. Provide unit with two DMX ports, each of which may be configured as input or output.
- E. Provide unit with 1024 channels of control.
- F. Provide unit and power supplies to support all specified interface stations.
- G. Provide unit with RS-232 interface to AV Control System Processor if direct Ethernet connection is not supported.
- H. Provide unit in rack-mount enclosure.
- I. Mount unit in Lighting Control Rack.
 - 1. ETC Unison P-ACP w/ERN2-RM-120 enclosure
 - 2. Strand equivalent

2.5 AUDITORIUM CONTROL CONSOLE

- A. Features
 - 1. Control Channels: 10,000
 - 2. DMX Channels: 2048
 - 3. Cues: 10,000
 - 4. Cue Lists: 1
 - 5. Presets: 1,000
 - 6. Groups: 1,000
 - 7. Effects: 1,000
 - 8. Macros: 1,000
 - 9. Hard disk storage
 - 10. USB port for storage, pointing and keyboard devices
 - 11. Hue / saturation color and gel picker color mixing
 - 12. On-screen magic sheets
 - 13. Submasters: 40
- B. Interface Options
 - 1. Support the following local interfaces:
 - a. AC input.
 - b. Keyboard and mouse
 - c. Ethernet (one port) 802.3af compliant.
 - d. Touch-sensitive displays

- C. Physical
 - 1. Console power shall be 95 – 240V AC at 50 or 60Hz, supplied via a detachable power cord.
- D. Acceptable Products
 - 1. ETC Ion 2000 w/ FADW 2x20
 - 2. Strand NEO
 - a. Quantity: 1

2.6 AUDITORIUM CONTROL CONSOLE ACCESSORIES

- A. Provide radio-frequency focus remote with associated access point. Provide access point with pipe mounting hardware.
- B. Wi-fi access point and mounting hardware.
- C. Provide keyboard, mouse, dustcover, power cord, manual.
- D. Provide two 24" single-touch flat-panel LCD monitors on tilting and height-adjustable stands.
- E. Provide 25-foot Ethernet cable and 25-foot DMX control cable.
- F. Uninterruptible power supply
- G. Dimmable gooseneck worklight.

2.7 ARCHITECTURAL CONTROL PANELS

- A. Entry Panel (EP)
 - 1. Provide control station per drawings for installation in a one-gang electrical box.
 - 2. Provide back box for surface mount locations.
 - 3. Provide in finish per schedule.
- B. Preset Panel (PP)
 - 1. Provide five-button, station for installation in a one-gang electrical box.
 - 2. Provide back box for surface mount locations.
 - 3. Provide in finish per schedule.
- C. Fader Panel (FP)
 - 1. Provide twelve-button, seven-fader control station for installation in a four-gang electrical box or rack panel.
 - 2. Provide back box for surface mount locations.
 - 3. Provide rack panel for rack-mount locations.
 - 4. Provide in finish per schedule.
 - 5. Custom legend per Drawings.
- D. Touch Panel (TP)
 - 1. Provide 7-inch touch panel for installation in custom back box or rack panel.
 - 2. Provide back box for surface and flush mount locations.
 - 3. Provide rack panel for rack mounted locations.

2.8 NETWORK COMPONENTS

- A. Ethernet Switch
 - 1. Provide managed network switch as required for operation of the network system. Provide switches with the following properties:

- a. Twenty-four (24) managed dual speed auto-sensing ports supporting 100BaseT and 10Base-T.
 - b. All ports on the switch shall provide Power Over Ethernet.
 - c. Support for multicast Ethernet
 - d. IGMP snooping compatible
 - e. Mount in standard 19 inch equipment rack.
 - f. Acceptable Manufacturers:
 - 1) Cisco
 - 2) HP ProCurve
 - 3) Juniper
 - 4) Approved Equal
 - B. Ethernet Patch Bay
 1. Provide Category 5e patch bay as required for termination of all lighting network UTP runs in the equipment rack.
 2. Provide patch cords as required for connection to the Ethernet Switch.
 3. Mount patch bay in standard 19" equipment rack.
 - C. Cable Management
 1. Provide rack-mounted brush-type cable management.
 2. Mount unit between Ethernet switch and Ethernet patch bay.
- 2.9 CONTROL DEVICES
 - A. General
 1. Provide back boxes for all surface and pipe mounted devices and all devices that will not fit in a standard electrical gang box.
 2. Provide all required mounted hardware for surface and pipe mounted back boxes.
 3. Label back boxes and faceplates with unique designations printed on removable adhesive labels to correspond to shop drawings.
 - B. Portable One-Port Ethernet Node
 1. Ethernet node shall translate Ethernet-based control protocol into DMX-512.
 2. Node shall be powered via its Ethernet connection using Power Over Ethernet.
 3. Provide 10' Category 5e rough service extension cable with Neutrik Ethercon connectors with each node.
 4. Provide 5' long male to male turnaround XLR-type cable to allow node to be used as DMX input.
 5. Provide node with c-clamp for mounting to pipe.
 - a. Quantity: 6
 - C. Ethernet Tap (ET & ET2)
 1. Provide device with RJ-45 Ethercon receptacles as indicated on Drawings.
 2. Provide flush, surface or pipe mount as indicated on the Drawings.
 3. Provide tap complete with back box, faceplate and any required mounting hardware.
 4. Label receptacle(s) with designation corresponding to termination of network cable in Ethernet patch bay.
 5. Provide faceplates in public areas in color per Architect.
 - D. Portable House Lighting Console
 1. Provide portable lighting control station in table-top enclosure with 7-inch touch panel.
 2. Provide with 15-foot permanently attached cable with hard service connector.
 3. Provide in finish per Architect selected from manufacturer's full range of standard finishes.
 - a. Quantity: 2
 - E. DMX Ethernet Node and Opto-Isolator

THEATRICAL LIGHTING CONTROLS AND FIXTURES

1. Provide Ethernet-based RDM-compliant DMX node and 4-way DMX repeater designed for permanent installation. Mount in Lighting Control Rack. Provide with power supply as required.
 - a. Pathway 1011 and 4813
 - b. Equal
 - F. Power Loss Sensor
 1. Provide UL924 listed power loss sensor kit to trigger DMX Bypass Unit. Provide with restore switch to allow user to manually restore normal operation when normal power returns. Provide with over-current protected sensing circuit.
 - a. ETC EBDK w/ EBDK-SWITCH
 - b. Equal
 - G. DMX Bypass Unit
 1. Provide UL924 listed DMX controller to trigger "full-on" for emergency LED architectural fixtures on trigger from Power Loss Sensor.
 - a. ETC DEBC
 - b. Equal
 - H. Occupancy Sensor (OS)
 1. Provide ceiling-mounted passive infrared occupancy sensor compatible with architectural lighting processor.
 2. Provide unit suitable for installation in high ceiling.
 3. Provide in black or white, per Architect.
- 2.10 LIGHTING CONTROL RACK
 - A. Provide wall-mount swing-out equipment rack to contain lighting control network equipment.
 - B. Provide with 2 rack-unit storage drawer.
 - C. Size rack as required by system components plus 4 rack spaces unused and covered with blank panel for future expansion.
 - D. Provide with locking front door, rack light and blank panels as required.
 1. Middle Atlantic DWR Series
 2. Lowell Mfg. L250 series
- 2.11 DISTRIBUTION DEVICES
 - A. Provide dimmed and switched power distribution devices as shown on the Drawings.
 1. All devices shall be constructed of sheet metal. Provide all required mounting hardware.
 2. All devices shall be provided with terminal strips for interconnection to the dimming system wiring.
 3. Outlet and Pigtail Boxes shall be fabricated from 18-gauge cold rolled steel with 16 gauge covers. They shall be finished with fine-textured, scratch-resistant, powder coat. Color per Architect.
 4. Circuit numbers shall be 3/4" labels with white letters on black background. Pigtails and outlets shall be spaced on as shown on the Drawings.
 5. Provide hanger brackets for connector strips as required.
 6. Label back boxes and faceplates with unique designations printed on removable adhesive labels to correspond to shop drawings.
 7. Provide devices with finishes per schedule.
 8. Provide Kellems style mesh strain relief per Drawings.

- B. Provide flexible multi-cable for distribution devices mounted on flown electrics. Provide junction box with terminal strip for attachment to wall. Provide multi-cable of sufficient length to allow for full travel of electric. Provide multi-cable with Kellems style mesh strain-relief at both ends.

2.12 LIGHTING FIXTURES

- A. General
 - 1. Furnish all fixtures with installed edison connector on power cable, c-clamp, 10' DMX cable, and black safety cable.
- B. LED Ellipsoidal Reflector Spotlight – Body
 - 1. Provide color-changing LED ellipsoidal body suitable for interchangeable lenses, using 150 watts power (maximum) and with DMX in and through, power in and through and pattern holder. Provide unit with 20,000-hour LED life, 7-color mixing and variable control profiles.
 - 2. Provide fixtures that provides a minimum of 5,300 Lumens while producing 3000 Kelvin white light.
 - a. ETC Source 4 LED Series 2 Lustr (Black)
 - b. Strand equal
 - 1) Quantity: 48
- C. 19 Degree Lens Tube
 - 1. ETC 419EDLT
 - a. Quantity: 14
- D. 26 Degree Lens Tube
 - 1. ETC 4 26EDLT
 - a. Quantity: 16
- E. 36 Degree Lens Tube
 - 1. ETC 436 EDLT
 - a. Quantity: 2
- F. LED PAR
 - 1. Provide LED PAR fixture with seven-color mixing, DMX in and thru, power in and thru, hanging yoke. Provide with four lens set.
 - a. ETC ColorSource PAR
 - 1) Quantity: 24
- G. LED Cyclorama Light
 - 1. Provide color-changing LED cyclorama lighting fixtures with installed Edison connector, c-clamp, power supply, lens and all required accessories.
 - 2. Provide each fixture with 10-foot long DMX cable.
 - 3. Provide with any required power distribution required for fixture use on electric batten.
 - a. ETC Paletta 11 inch w/ H80 and V20 lenses
 - b. Equal
 - 1) Quantity: 15
- H. LED Worklight
 - 1. Provide LED-based, tungsten-balanced, convection-cooled, 90+ CRI work light for use on electrics battens, pipe grid and catwalks. Provide each unit with c-clamp, safety cable and installed Edison connector.
 - a. Altman LED Worklight
 - b. Equal
 - 1) Quantity: 6
- I. Follow Spot

THEATRICAL LIGHTING CONTROLS AND FIXTURES

1. Provide metal halide follow-spot appropriate for 45-foot throw with approximately 10 degree to 22 degree zoom. Provide unit with iris, mechanical douser, and boomerang color changer. Provide with 25 foot power cable and two lamps (one spare). Provide with yoke and stand with pipe clamps suitable for mounting to catwalk pipe.
 - a. Robert Juliat Model Cricket
 - b. Equal
 - 1) Quantity: 2

2.13 SHARED ACCESSORIES

- A. Side Arms
 1. Provide 24-inch side arms with two sliding tees for use on "box boom" positions.
 2. Provide side arm with clamp and secondary support brace, designed to attach to vertical pipe. C-clamp attachment is not acceptable.
 3. Install side arms 22 inches apart.
 4. Provide:
 - a. City Theatrical #204
 - b. Equal
 - 1) Quantity: 12
- B. Template Holders
 1. A-size Template Holder
 - a. Quantity: 30
- C. Black Safety Cable (spare)
 1. Quantity: 75
- D. Extension Cables
 1. Provide 12/3 SO edison extension cables with color-coded length marker and knotted tie line in length as quantities below
 - a. 5 foot: 40
 - b. 10 foot: 35
 - c. 25 foot: 25
 - d. 50 foot: 15
 2. Provide molded edison pin two-fer.
 - a. Quantity: 40
 3. Provide power "thru" cable with PowerCon male to Powercon Female, or as appropriate for fixtures.
 - a. 5 foot: 15
 - b. 10 foot: 10
 4. Provide hard-service DMX extension cables with color-coded length marker and knotted tie-line in lengths and quantities below:
 - a. 5 foot: 10
 - b. 10 foot: 15
 - c. 25 foot: 5
 5. Ethercon Ethernet Extension Cables
 - a. Provide black heavy-duty Cat5e extension cable with Neutrik Ethercon connectors and quantities below.
 - b. Acceptable Products
 - 1) Lex Products CAT5-EC
 - 2) Equal
 - a) 5 foot: 10
 - b) 10 foot: 10
 - c) 25 foot: 5

THEATRICAL LIGHTING CONTROLS AND FIXTURES

- E. Lens Storage Cart
 - 1. Provide four-stack "poker chip" style dish dolly for storage of spare PAR lenses.
 - a. Metro Dish Dolly
 - b. Cambro
 - c. Equal
 - 1) Quantity: 2
- F. Storage Hamper
 - 1. Provide six-bushel canvas storage hamper with steel frame, heavy-duty castors and hinged plywood top for storage of spare instruments and cable.
 - a. Steele Canvas Model 82
 - b. Equal
 - 1) Quantity: 4

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where performance dimming and control equipment is to be installed and verify that conditions are satisfactory for installation, complying with both the Manufacturer's requirement and this specification.

3.2 INSTALLATION

- A. Coordinate installation of system with Electrical Contractor.
- B. Terminate all low-voltage connections.
- C. Load circuit conductors shall be continuous from the dimmer room to the back box. Do not splice conductors.
- D. Coordinate control with Audiovisual System Contractor:
 - 1. Create presets within control processor for recall by audiovisual control system.
 - 2. Coordinate IP addressing scheme if direct Ethernet connection is made from audiovisual control system to lighting system.
- E. Lighting fixtures:
 - 1. Deliver lighting fixtures to designated area
 - 2. Unpack all fixtures, remove packing materials
- F. Architectural Control
 - 1. Program presets in consultation with Owner and Consultant.
 - 2. Program the following modes, to be activated from portable touch panel in Auditorium and Black Box Theater:
 - a. Standard mode
 - 1) Adjust daylight harvesting zone house lighting level based on signal from daylight sensors – reference Electrical drawings for zoning
 - 2) Entry panels active
 - 3) Reset system to Standard Mode every night at 1 AM
 - b. Show mode
 - 1) House lighting level set by panel or console, no daylight harvesting
 - 2) Entry panels disabled

- G. Architectural Lighting Fixtures
 - 1. Perform all DMX terminations on DMX-controlled LED drivers in Auditorium and Black Box Theater.
 - 2. Coordinate and integrate DMX addressing scheme with Electrical Contractor.
 - 3. Test DMX addressing and RDM functionality of LED drivers.
 - 4. Address all lighting fixtures.

3.3 FIELD QUALITY CONTROL

- A. Post-Completion Inspection Report
 - 1. Test all dimmed and switched power outlets for correct electrical termination and for correct control.
 - 2. Confirm that all architectural lighting fixtures that are controlled by the theatrical dimming system are operational and lamped.
- B. Manufacturers' Field Services
 - 1. Provide the services of a Manufacture-certified field service technician to verify the installation and operation of the control system.

3.4 SYSTEM CHECKOUT

- A. After receipt of the Post-Completion Inspection Report, the Architect will schedule an inspection and operational test of the system.
- B. Make all loose equipment specified for the lighting system available at time of checkout.
- C. Provide full and uninterrupted access to stage, auditorium and technical areas required for commissioning tests. Occasional blackouts of the lighting will be required during this checkout.
- D. A Contractor's project representative shall be present during tests.
- E. Provide a Manufacturer's certified field service technician shall be present during all tests and inspections and available for system programming.
- F. Provide personnel to operate equipment and perform adjustments as necessary.
- G. Provide access to equipment as required.

3.5 DEMONSTRATION AND TRAINING

- A. Provide 12 hours of training in three separate sessions, by factory-authorized personnel, for end-users in the operation of the system.

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.
 - 2. Elevating dock.
- B. 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.
 - 2. Section 055000 - METAL FABRICATIONS for framing and supports for strip door curtains.

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. 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.
- C. 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. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55 (380).
- C. Steel Tubing: ASTM A 500, cold formed.
- D. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- E. Wood: DOC PS 20 dimension lumber, select structural grade, kiln dried.
- F. 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 ELEVATING DOCK

- A. General: Built-in, scissors-type, single-leg, hydraulic dock lift of capacity, size, and construction indicated; complete with controls, safety devices, and accessories required.
1. Manufacturers: Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Lifts, Inc.
 - b. Blue Giant Equipment Corporation.
 - c. Pentalift Equipment Corporation.
 - d. SPX Dock Products - Kelley.
 2. Basis-of-Design: Pentalift Model HED81015.
- B. Standard: MH 29.1.
- C. Rated Capacity: 15000 lbs.
- D. Platform: Nonskid, safety-tread heavy steel deck plate.
1. Platform Size: 96 in. by 120 in.
 2. Platform Guarding: Comply with requirements in MH 29.1.
 3. Fixed Handrails: Equip lift with handrails on two sides of platform with a single, removable chain across each end. Provide handrails not less than 39 inches high with midrail and 4-inch-high kick plate at bottom.
- E. Bridge: Nonskid, safety-tread steel plate.
- F. Function: Dock lifts shall compensate for differences in height between truck bed and loading platform.
1. Vertical Travel: 59 in.
 2. Low Height: 15 in.
 3. Raised Height: 71 in.
 4. Hinged Throw-Over Bridges Operation: Manual.

- G. Hydraulic Operating System: Self-contained, electric, hydraulic power unit for raising and lowering lift; of size, type, and operation needed for capacity of lift indicated; controlled from a remotely located push-button station.
 - 1. Remote-Control Station: Multibutton control station of the constant-pressure type with UP and DOWN push buttons. Controller shall consist of magnetic motor starter with three-pole adjustable overloads and 24-V control transformer with 4-A, fused secondary prewired to terminal strips and enclosed in NEMA ICS 6, Type 12 box.
 - a. Upper-Travel-Limit Switch: Equip unit with manufacturer's standard, adjustable, upper-travel-limit switch.
- H. Accessories:
 - 1. Access Chain End: Access chains for guard rails/lip post on fixed end.
 - 2. Guard Rail: Pocket Style 42 in. high c/w mid-rail and 4 in. kick plate; Side B 120 in. long, Side D 120 in. long.
 - 3. Lip RE: Split 84 in. wide by 24 in. long steel lip on 96 in. Side A.
 - 4. Reinforced Platform: 40,000 lbs Roll-Over capacity. Roll-over capacity in fully lowered position only. Include uprights on frame to support platform over-hang
 - 5. Toe Guards: Bevel Toe Guards Included In Net Price
 - 6. Hydraulic Velocity Fuse: Prevents free fall if the hydraulic hose is severed.
 - 7. Safety Striping: Full perimeter safety striping
 - 8. Trip Bars: Electrically interlocked perimeter bar suspended around platform, stops downward travel of table when activated by coming into contact with an obstruction.
 - 9. Power Unit Extra Hydraulic Hose: 10 ft of hose.
 - 10. Primary Control Extra Cord: 10 ft of cord.
- I. Construction: Fabricate lift from structural-steel shapes rigidly welded and reinforced for maximum strength, safety, and stability. Design assembly to withstand deformation during both operating and stored phases of service. Provide mounting brackets and removable lifting eyes for ease of installation.
- J. Dock Lift Finish: Hot-dip galvanized.
 - 1. Toe Guards: Paint yellow to comply with ANSI Z535.1.

2.4 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. Examine roughing-in for electrical systems for loading dock equipment to verify actual locations of connections before equipment installation.
- C. Examine walls and floors of pits for suitable conditions where recessed loading dock equipment is to be installed. Pits shall be plumb and square and properly sloped for drainage from back to front of loading dock.
- D. 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.
- C. Dock Lifts: Attach dock lifts securely to loading platform.

3.4 ADJUSTING AND CLEANING

- A. Adjust loading dock equipment for proper, safe, efficient operation.
- B. Test dock lifts for vertical travel within operating range indicated.
- C. Restore marred, abraded surfaces to their original condition.

END OF SECTION

SECTION 111320
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.
- 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 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.3 RELATED DOCUMENTS

- A. Refer to AE and AV series drawings and project architectural, structural and electrical drawings for information related to the work specified herein.
- B. Examine all Drawings and other Sections of the Specifications for requirements therein affecting the work of this trade.

1.4 SECTION INCLUDES

- A. Pipe mounted electrically operated projection screen, controls, accessories and mounting hardware.
- B. Fixed, recessed, electrically operated projection screen, controls, accessories and mounting hardware.

1.5 RELATED SECTIONS:

- 1. Section 27 41 16 - Integrated Audio-Visual Systems and Equipment
- 2. Section 11 06 10 – Stage Rigging and Curtains
- 3. Division 26 – Electrical Work

1.6 REFERENCES

- A. Society of Motion Picture and Television Engineers (SMPTE):
 - 1. SMPTE RP 94-2000 - Gain Determination of Front Projection Screens.

1.7 DEFINITIONS

- A. Gain: Indication of screen's luminance or brightness measured perpendicular of screen center and measured relative to a block of magnesium carbonate which serves as the standard for 1.0 gain. Higher numbers indicate greater brightness. Gain shall be determined in accordance with SMPTE RP 94-2000.
- B. Viewing angle: Angle from perpendicular center of screen at which the gain or brightness is decreased by 50 percent.
- C. Keystone: Distortion of projected image when screen is not perpendicular with center line of projected image.

1.8 COORDINATION

- A. Employ labor compatible with all on-site trades.
- B. Attend regular project meetings as scheduled by the General Contractor or Architect.
- C. Coordinate with the schedule of general construction work by others.

1.9 SUBMITTALS

- A. Provide in accordance with Section 0133000 - Submittal Procedures:
 - 1. Product data for projection screens and accessories.
 - 2. Shop drawings: Indicate dimensions, fabrication and installation details, and electric wiring diagrams.
 - 3. Samples:
 - a. Finishes for selection by Architect.
 - b. Viewing surface: 6 by 6 inches minimum size.
 - 4. Manufacturer's installation, operation, maintenance, and cleaning instructions.
 - 5. Site-specific installation and suspension details.

1.10 QUALITY ASSURANCE

- A. Manufacturer qualifications: Firm with 30 years minimum successful experience manufacturing electric projection screens.
- B. Motors for electric screens shall be certified by Underwriters Laboratory (UL), Inc. and shall bear UL label.

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver projection screens after building is enclosed and construction in rooms where screens will be installed is substantially complete.
- B. Deliver screens in manufacturer's undamaged, labeled packaging.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All equipment and materials shall be new, latest version at time of bid, and shall conform to applicable UL, CSA or ANSI provisions. Re-manufactured or "B" stock equipment will not be accepted without prior written consent from the Owner. Evidence of unauthorized re-manufactured, or "B" stock equipment on the project site will be deemed evidence of the

Contractor's Failure to Perform the Work. Care should be taken during installation to prevent damage (scratches, dents, chips, and disfiguration) to the equipment.

B. Accessories

1. Installation hardware: Provide all additional attachment hardware, fasteners, and other components of type, size, and spacing recommended by manufacturer for complete, functional, secure installation of electric screen.

2.2 AUDITORIUM MOTORIZED FRONT PROJECTION SCREEN

A. Acceptable Manufacturers

1. Da-Lite, Inc.
2. Draper
3. Stewart Filmscreen

B. Screen

1. Type: Electrically operated, tensioned, retractable, projection screen for recessed use
 - a. Model: Tensioned Professional Electrol
 - b. Mounting: Recessed in proscenium
 - c. Permanently attach screen fabric to roller.
 - d. Motor Option: Silent motor
 - e. Closure doors: none
 - f. Viewing surface: Da-Matte
 - 1) Gain: 1.0
 - 2) Viewing Half Angle: 60 degrees
 - 3) Size: per Drawings
 - 4) Provide with black masking bottom and sides: 3 inches
 - 5) Black drop: per drawings

C. Control

1. Provide with Ethernet control option
 - a. Coordinate room control system interface with Audiovisual Systems Contractor.
2. Low-voltage up/down/stop control switch in Stage Equipment Rack.

2.3 GYMNASIUM MOTORIZED FRONT PROJECTION SCREEN

A. Acceptable Manufacturers

1. Da-Lite, Inc.
2. Stewart Filmscreen
3. Or Equal

B. Screen

1. Type: Electrically operated, retractable, projection screen for surface mounting.
 - a. Basis of Design: Professional Electrol
 - b. Installation method: Surface mounted
 - c. Mounting: Wall Bracket
 - d. Permanently attach screen fabric to roller.
 - e. Option: Silent motor
 - f. Control: Low-voltage control, Wall switch
 - g. Closure doors: none
 - h. Tensioned: No
 - i. Viewing surface: Matte White

- 1) Gain: 1.0
- 2) Viewing Half Angle: 60 degrees
- 3) Size: per Drawings
- 4) Provide with black masking bottom and sides
- 5) Black drop: per Drawings

C. Control

1. Provide with low-voltage control option
 - a. Coordinate room control system interface with Audiovisual Systems Contractor.
2. Low-voltage up/down/stop control switch on wall in rack room.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate provision of electric screens with locations of other wall and ceiling mounted components such as visual display boards, casework, structural framing, light fixtures, air diffusers, ducts, and fire sprinklers to eliminate potential conflicts.
- B. Coordinate requirements for blocking and auxiliary structural supports to ensure adequate means for installation of screens.
- C. Coordinate requirements for power supply, conduit, and wiring required for electric screen and controls.
- D. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

- A. Install screens in accordance with approved shop drawings and manufacturer's installation instructions.
- B. Install projection screens at locations and heights indicated on Drawings. Verify locations in field with Architect.
- C. Install screens securely to supporting substrate so that screens are level and back of case is plumb.
- D. Adjust screen to be perpendicular to centerline of video projector beam.
- E. Set limit switches to position screen as shown on the Drawings.

3.3 TESTING AND PROTECTING

- A. Operate each screen three times minimum. Ensure screens properly extend and retract and that screen is level and viewing surface plumb when extended. Verify controls, limit switches, and other operating components are functional. Adjust to correct deficiencies.
- B. Projection surfaces shall be free from wrinkles.
- C. Protect projection screens from damage during subsequent construction activities. Remove and replace damaged screens.

END OF SECTION

SECTION 114000

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Sections, apply to this Section.

1.2 SCOPE

- A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer's standards and are required for this project.
- B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.
- C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.
- D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.
- E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.
- F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.
- G. Work in this Section shall include but shall not be limited to the following:
 - 1. Catalog items of equipment.
 - 2. Fabricated equipment other than catalog items.
 - 3. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
 - 4. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.
- B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.
- C. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.
- D. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.4 SUBMITTALS

- A. Submit Shop Drawings for approval in accordance with the General Conditions.
- B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.
 - 1. Hand drawn scale: 1/2 in. = 1 ft., 0 in.
 - 2. CAD drawn scale: 1/4 in. = 1 ft., 0 in.
 - 3. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
 - 4. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
 - 5. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
 - 6. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned
- C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.
- D. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.
- F. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.
- G. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.

- H. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.

1.5 SAMPLES

- A. If the bidder's proposed equipment fabricator is unknown to the Consultant's office, immediately after award of contract, submit the following samples for selection and approval:
 - 1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
 - 2. Drawer assembly (will be returned for use on this project).
- B. Work delivered to the job shall match approved samples.

1.6 GUARANTEES AND WARRANTIES

- A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.
- B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is required, the Owner shall have the option of full use of the defective equipment until a replacement has been delivered and completely installed.
- C. Furnish manufacturer's warranties for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.7 REGULATORY AGENCIES

- A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.
- B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.
- C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).
- D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).
- E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.
- F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.

1.8 EQUALITY OF MATERIALS AND EQUIPMENT

- A. The base bid shall contain no substitutions to these drawings or specifications. Bidders may offer substitute equipment in a separate proposal, indicating the proposed model and sum to be added or deducted if the alternate item is accepted by the Owner. Each line item shall include delivery, installation and taxes. Decisions to accept or reject a piece of equipment shall be made by the Owner, and all decisions shall be final.

PART 2 - PRODUCTS

2.1 MATERIALS AND FINISHES

- A. General
 - 1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.
 - 2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.
- B. Stainless Steel
 - 1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.
- C. Galvanized (Galvannealed) Steel
 - 1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.
- D. Plastic Laminate Materials
 - 1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
 - 2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer's specifications.
 - 3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
 - 4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
 - 5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

2.2 CONSTRUCTION

- A. General

1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. Welding

1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.
2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.
3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grinding, Polishing and Finishing

1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.
2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.
3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.
4. Excessive distortion caused by welding shall be cause for rejection for that item of equipment.

2.3 BUY-OUT COMPONENTS

- A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal.

- B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal.
- C. DOOR AND DRAWER PULLS: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal.
- D. DOOR HINGES: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002.
- E. DRAWER PANS: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal.
- F. DRAWER SLIDES: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal.
- G. FAUCET SETS, DECK MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on swivel nozzle or swivel gooseneck to suit the application; T&S Brass B-0221 or B-0321, or equal by Component Hardware, Chicago, or Fisher.
- H. FAUCET SETS, POTWASHING SINK: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-290.
- I. FAUCET SETS, SPLASH MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231 or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.
- J. GUSSETS: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal.
- K. LEG AND BULLET FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal.
- L. LEG AND FLANGED FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal.
- M. NUTS: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal.
- N. SEALANT: Silicone type sealant for sealing equipment to walls or filling crevices between components, TRANSLUCENT, NSF approved; Component Hardware M90-1010, or Dow Corning 732-RTV.
- O. SOUND DEADENING BASINS: Component Hardware Q75-1366
- P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225 "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.

- Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal.
- R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000.
- S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal.
- T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.

2.4 FABRICATED COMPONENTS

A. Box Type Cabinet Construction

- 1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
- 2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
- 3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in. welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards

- 1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.
- 2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.
- 3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails

- 1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly

1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.
2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.
3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.
4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges

1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.
2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.
3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
4. Short (6 in.) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.
5. Tall (10 in.) splash on preparation sinks, dishtables, counters, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.
6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves

1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvannnealed steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.
2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.
3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors

1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.
2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts

1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Sliding Doors

1. Sliding doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle. Provide sliding doors with nylon roller bearing sheaves and overhead track components equal to Component Hardware B58-5523 and 5513 sheaves, B57 track, B62-1093 nylon door guides and B60-1086 door stops.

J. Undershelves

1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

K. Wall Brackets

1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in. wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.
2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.

L. Wall Shelves

1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.5 ELECTRICAL EQUIPMENT AND WIRING

- A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.
- B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.
- C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter's Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.
- D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.6 ITEM SPECIFICATIONS

PART 3 - EXECUTION

3.1 SANITATION REQUIREMENTS

- A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation shall be referred to the State Department of Health for a ruling.
- B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.2 EXAMINATION AND ACCEPTANCE

- A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.
- B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work shall be construed as acceptance of space conditions.

- C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.
- D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.3 CLEANING UP

- A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.4 DEMONSTRATION AND OPERATING INSTRUCTIONS

- A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.
- B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.
- C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Book shall be turned over to Owner after review and approval.
- D. Submit guarantees and warranties to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.5 PROTECTION OF WORK

- A. Protect specified 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 under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

3.6 EXISTING EQUIPMENT

- A. Foodservice equipment that is scheduled for reuse shall be removed and stored in a location provided by the General Contractor on site. This Contractor shall provide transportation of equipment.
- B. Verify and document the operating condition of all relocated equipment prior to its being disconnected. Document the condition of the equipment to note any dents, scratches, broken components or other damage prior to placing it in storage. Protect equipment during transport and storage, and assume responsibility for its re-installation in the condition viewed prior to removal. Transport and install the equipment in accordance with Item Specifications.
- C. This Contractor is not responsible for refurbishing equipment noted as "Existing" on plans or specifications unless work is specifically called for in the Item Specifications.
- D. Disconnecting and reconnecting of services to "Existing" equipment shall be performed by related trades.
- E. This Contractor shall restart all existing equipment following its reconnection to building services and verify its correct operation as viewed prior to removal.
- F. This Contractor shall not provide a warranty or guarantee on "Existing" equipment. In the case of a new component being provided by this Contractor for an "Existing" piece of equipment, the component shall be warranted or guaranteed as specified hereinbefore.
- G. Foodservice equipment that is scheduled for reuse must be verified for NSF certification.

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 01 – 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. Motorized and folding 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.
 - 6. Installation of Owner furnished obstacle course system.
 - 7. Baseball net.
 - 8. Mat hoist.
 - 9. Steel required to support backstops, athletic equipment and divider curtain from structure
- D. Products furnished, but not installed, under this Section include the following:
 - 1. Volleyball floor inserts, for installation under Division 09, athletic flooring sections.
 - 2. Wall-mounted controls, installed under Section 260000 – ELECTRICAL.
- E. Related work includes but is not limited to the following work covered in other sections:
 - 1. Power for electric basketball backstop winches, divider curtain, 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. 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.
- C. Samples:
 - 1. Gymnasium divider curtain Fabric: Not less than 4 inches square of open mesh, and of opaque fabric.
- D. Manufacturer's Data: Submit manufacturer's product data with performance, operating and electrical characteristics for all equipment together with catalogue cuts.
- E. 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:
 - a. Draper, Inc.
 - b. Performance Sports Systems.
 - c. Porter Athletic Equipment Company.
 - d. Approved equal.
 - 2. Gymnasium Divider Curtains:
 - a. Draper Inc.
 - b. Performance Sports Systems.
 - c. Porter Athletic Equipment Company.
 - d. Approved equal.
 - 3. Basketball scoreboards and shot clocks:
 - a. Daktronics, Inc.
 - b. OES Scoreboards
 - c. NEVCO, Inc.
 - d. Approved equal
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Porter Athletic Equipment Company and Daktronics, Inc 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.
 - 3. Backstops shall be operable on the swing-up principle, storing in minimal area when not in use.

- 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: Provide manufacturer's high performance finish system in colors as selected by Architect from manufacturer's full range.
- 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. Adjustment: Unit shall be provided with a 6" adjustment up or down for obtaining proper goal height. Goal shall be adjustable in height from 8'-0" to 10'-0" above the finished floor.
1. Product: Porter Athletic Equipment Company, *Model 00900-506 Center-Strut Height Adjustment System*, or equal by manufacturer of backstop.
- J. Motorized Winch: Worm gear type, ½ 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: 1/2 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 ½ H.P. Electric Winch*, or equal by manufacturer of backstop.
- K. 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.
- L. Accessories: Provide all fastenings and other accessories as required for a fully functioning backstop 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. 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. 00570-0XX SuperSafe Certified Fire-Retardant Wall Padding*, or equal by approved manufacturer.

2.4 VOLLEYBALL EQUIPMENT

- A. Volleyball Standards: One pair of rigid-braced, telescoping, portable 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: One pair 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 and quantities.
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: Electrically operated, roll up, 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. 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: Roll-up drive tube.
- H. Gymnasium Divider Curtain Electric Operator: Provide operating machine of size and capacity recommended by manufacturer for equipment specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, and remote controls. Coordinate wiring requirements and electrical characteristics with building electrical system.
 - 1. Operator Type: Electric motor, enclosed gear-head-reduction drive, with chain and sprocket secondary drive.
 - 2. Motor Characteristics: Sufficient to start, accelerate, reverse, and operate connected loads at designated speeds within installed environment and with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG 1, and the following:
 - 3. Voltage: 120 V.

4. Horsepower: 3/4 hp.
 5. Enclosure: Manufacturer's standard.
 6. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.
 7. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
 8. Phase: One.
 9. Remote-Control Station(s): NEMA ICS 6, Type 1 enclosure for recessed or flush mounting, momentary-contact, three-position switch-operated control.
 - a. Keys: Provide two key(s) per station.
 - b. Product: Porter Athletic Equipment Company, *Model No. 791 Key Switch Control*, or equal by approved manufacturer.
- I. Product: Porter Athletic Equipment Company, *Model No. 90675-00 Roll-Up Gymnasium Divider Curtain*, or equal by approved manufacturer.

2.6 SCOREBOARD AND SHOT CLOCKS

- A. General: Scoreboard and shot clocks shall meet requirements for FCC Class A.
1. Provide one scoreboard and two shot clocks in Gymnasium.
- B. Basketball Scoreboard: Standard electronic scoreboard with LED displays controlled by wireless remote control system.
1. General:
 - a. Scoreboard face and perimeter material: 0.063" (1.60 mm) thick aluminum.
 - b. Scoreboard back material: 0.050" (1.27 mm) thick aluminum.
 - c. Overall Dimensions: 4'-0" (1.2 m) tall by 8'-0" (2.4 m) long by 8 inches (203 mm) deep.
 - d. Finish: Powder-coat; color as selected by Architect from manufacturers full range.
 2. Display:
 - a. Digits: 100,000 hour-rated, LED digits, minimum 13 inches 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: Daktronics Model BB-2101, or equal by approved manufacturer.
- C. Shot Clocks
1. General:
 - a. Shot clock face and perimeter material: 0.063" (1.60 mm) thick aluminum.
 - b. Shot clock back material: 0.050" (1.27 mm) thick aluminum.
 - c. Overall Dimensions: 2'-0" (610 mm) tall by 2'-0" (610 mm) long by 8 inches (203 mm)

- deep.
- d. Finish: Powder-coat; color as selected by Architect from manufacturers full range.
- e. 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: Daktronics BB-2114-15 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, volleyball and wrestling.
 - 2. Transformer: 12-volt DC wall transformer
 - 3. Transmitter: FCC Part 15-certificed, 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 Division 09 FINISHES, Athletic Flooring specification sections.
- 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, using supports and framing as recommended by manufacturer.
- C. Coordinate installation with the work of Section 260000 – Electrical, for power supply and completion of the keyswitch controls for raising and lowering curtain

3.6 INSTALLATION OF SCOREBOARD AND SHOT CLOCKS

- A. Install scoreboard 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 122110

HORIZONTAL LOUVER MINIBLINDS

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. Miniblinds with aluminum louver slats.
- B. 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 horizontal louver blinds and accessories.
 - 2. Section 081110 - HOLLOW METAL DOORS AND FRAMES for typical mounting substrate.

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.
- B. Shop Drawings: Show location and extent of horizontal louver blinds. 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.
- C. Samples for Verification: Louver slat in specified color, minimum 12 inches long.
- D. Window Treatment Schedule: Include horizontal louver blinds in schedule using same room designations indicated on Drawings.
- E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining horizontal louver blinds and finishes.
 - 2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.
 - 3. Operating hardware.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver blinds in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install horizontal louver blinds 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 horizontal louver blinds 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. 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. Hunter Douglas Window Fashions.
 - 2. Levolor Contract; a Newell Company; Levolor.
 - 3. SWF Contract: Bali S3000 Series.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM LOUVER SLATS

- A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.
 - 1. Nominal Slat Width: 1 inch for miniblinds.
 - 2. Nominal Slat Thickness: Not less than 0.008-inch.
- B. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends
- C. Tilt Control: Consisting of enclosed worm gear mechanism[, slip clutch or detachable wand preventing overrotation, and linkage rod, for the following operation:
 - 1. Tilt Operation: Manual with clear plastic wand
 - 2. Length of Tilt Control: Length required to make operation convenient from floor level.
 - 3. Tilt: Full.

- D. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.
- E. Ladders: Evenly spaced to prevent long-term louver sag; braided string.
- F. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
 - 1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.
 - 2. Blinds shall be mounted within each mullion section for each individual pane of glass.
- G. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard, as indicated.
- H. Colors, Textures, Patterns, and Gloss: As selected by the Architect.

2.3 HORIZONTAL LOUVER BLINDS FABRICATION

- A. Product Standard and Description: Comply with AWCMA Document 1029, unless otherwise indicated, for each horizontal louver blind designed to be self-leveling and consisting of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Lifting and Tilting Mechanisms: 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. Blind Units Installed between (Inside) Jambs: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.
- D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail and operating hardware, and for hardware position and blind mounting method indicated.
- E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.
- F. Color-Coated Finish: For 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.
- G. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HORIZONTAL LOUVER BLIND INSTALLATION

- A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

3.3 ADJUSTING

- A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean blind 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 horizontal louver blinds are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

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. Room Darkening and Black-Out roller shades with manual and motorized shade operators for window and skylight locations.
- B. 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 WORK 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. 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.
- C. 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.
- D. Samples for Initial Selection: For each colored component of each type of shade indicated.
1. Include similar Samples of accessories involving color selection.
- E. 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.
 - b. Fascia: Full-size unit, not less than 12 inches long.
- F. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
- G. Product Certificates: For each type of roller shade, signed by product manufacturer.
- H. Qualification Data: For Installer.
- I. Product Test Reports: For each type of roller shade.
- J. 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 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. 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.; FlexShade systems.
 - 2. MechoShade Systems, Inc.
 - 3. Walk-Tech Roller Shade System (by Rollease).
 - 4. Approved equal.
- B. Shade Band Material: Flame-retardant, fade-resistant washable woven vinyl, fused to a 500 Denier polyester core. Fabric shall be UV-resistant, dimensionally stable, closed, and densely woven.
 - 1. Colors: As selected by Architect from manufacturer's full range. Provide colors as selected by Architect for each side of shade (different colors are required for exterior and interior sides).

2. Material Openness Factor: 2-3 percent for south/west/east facing room darkening shades, 5 percent for north facing room darkening shades, 1 percent for skylight shades, and opaque for black-out shades.
 3. Bottom Hem: Straight
 4. Products: Provide Mecho5 Room Darkening/Blackout Series with side and sill channels as manufactured by Mechoshade Systems, Inc., or approved equal for black-out shades. Provide Mecho5 Series as manufactured by Mechoshade or approved equal for room darkening shades. Provide Electro2 as manufactured by Mechshade or approved equal for Motorized shades.
 5. Locations: Unless otherwise indicated on drawings, provide shades as follows:
 - a. **Dual Roller (room darkening and black-out) Shades: Science rooms.**
 - b. **Room-darkening Shades: All exterior windows and curtain wall, except for stairs, corridors, lobby, vestibules, and ramps, and elsewhere as indicated on drawings.**
 - c. **Room-darkening Shades: Skylights.**
- C. 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.
- D. Direction of Roll: Regular, from back of roller
- E. Mounting Brackets: Galvanized or zinc-plated steel.
- F. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as required to cover full length of roller and brackets, removable design for access.
- G. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.
- H. Bottom Bar: Steel or extruded aluminum. Provide exposed bottom bar with seal as required for smooth, properly balanced shade operation.
- I. Mounting: As indicated on Drawings, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
- J. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.
- K. Provide manually and motorized operated roller shades as follows:
1. Chain sprocket for manual operation: One piece moulded delrin. Drive shall be offset behind re-turn edge of fascia. Chain shall be standard chrome-plated beaded type as approved with tension pulley at free end. Chain-drive clutch system shall have continuous cord and pulley. Shades shall be able to be positioned at any level.
 2. Brake: Linear disc type with vibration resistant steel and nylon locking nut to maintain and adjust braking friction. Brakes shall be self-adjusting using a compression spring and nylon washers for continuous uniform compensating brake pressure on the sprocket/brake drive component.
 3. Motorized Shade Operators: Provide motorized operators at indicated locations and

in accordance with specifications herein below.

4. Operation: Free-fall, dynamic mode with predetermined stop positions and friction, static mode with infinite stop positions. Required force to operate shall not exceed similar standard shade effort. Provide chains and pulleys as required for manual operation. Include fabric-wrapped aluminum bottom rod of adjustable weight with color-coordinated end caps. Wire switches to motors and test operation in presence of the Architect.

- L. Jamb Channels for blackout shades and skylight shades: 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 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 12 3000 Manufactured Casework

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 which 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 DESCRIPTION OF WORK

- A. Work of this Section includes all labor, materials, equipment and services necessary to complete the manufactured casework and equipment as shown on the drawings and specified herein, including but not limited to, the following:
 - 1. Provide all fillers, scribes, finished ends, finished backs, work surfaces, back-splashes and cutouts required to provide a complete and finished project. Plastic laminate work surfaces shall include backer sheet.
 - 2. Furnish plumbing fixtures, including nipples, locknuts, required for mounting in or on the Equipment. Furnish all fixtures unattached and unassembled properly tagged and identified with installation information.
 - 3. Furnish sinks, including overflows, plugs, strainers and tailpieces which occur above the floor; nipples and nuts required for mounting equipment; and basins. Furnish fittings unattached and unassembled, properly tagged and identified with installation information.
 - 4. Furnish electrical service fixtures, including nipples, required for mounting in or on equipment, unless specified otherwise. Furnish all fixtures unattached and unassembled, properly tagged and identified with installation information.
 - 5. Furnish light fixtures including switches, integral convenience receptacles and other components, as required for installation in or on the equipment; and fixtures and fittings that are a functional integral part of the equipment. Fixtures and fittings shall be factory-installed and pre-wired.
 - 6. Furnish integral convenience receptacles and other components, as required for installation in or on the equipment; and fixtures and fittings that are a functional integral part of the equipment.
 - 7. Provide locks in on all casework doors and drawers except on sink cabinet doors.
 - 8. Comply with laws, ordinances, rules and regulations of all local, state and federal authorities having jurisdiction, the rules and regulations of the National Board of Fire Underwriters and the local electric code.
 - 9. Remove all debris, dirt and rubbish accumulated as a result of this installation, and leave the premises clean and completed work ready for use. Clean equipment interiors, exteriors, and work-tops. Residue left from cleaning agent shall be completely removed.
 - 10. Verify and confirm all building dimensions relative to equipment by taking actual field measurements at the job prior to equipment fabrication.

11. Coordinate the design, connections, delivery and installation of equipment furnished under this Section with all other related trades and associated work under the Contract.
 12. Provide equipment/appliances equal to or exceeding the quality and function described in this Section and shown on the Schedules on the Fixed Casework Drawings.
- B. Related work includes but is not limited to the following work covered in other sections:
1. Section 055000 – METAL FABRICATIONS, for brackets to support counters with aprons only.
 2. Section 061000 – ROUGH CARPENTRY, for wood blocking, furring, shims and hanging strips for installing manufactured casework and concealed within other construction before manufactured casework installation..
 3. Section 064000 – FINISH CARPENTRY AND ARCHITECTURAL WOODWORK, for custom cabinets, shelving, counters and other casework as shown on Drawings.
 4. Section 092900 – GYPSUM BOARD, for reinforcements in veneer plaster partitions for anchoring manufactured casework.
 5. Delete first subparagraph below if base for manufactured casework is specified in this Section.
 6. Section 096500 – RESILIENT FLOORING, for resilient base applied to manufactured casework.
 7. Division 22 and 23 – PLUMBING, for plumbing rough-in and connections for sinks to be installed in manufactured casework.
 8. Division 22 and 23 – PLUMBING, for gas plumbing rough-in and connections for gas fittings to be installed in manufactured casework.
 9. Division 26 – ELECTRICAL, for electrical receptacle installed on or near casework, and for connection to casework-mounted electrical receptacles on Science Demonstration Islands.
- C. Sustainable Design Intent: Comply with project requirements intended to achieve a score of 34, measured and documented according to the Collaborative for High Performance Schools – Massachusetts. 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.

1.3 SUBMITTALS AND SHOP DRAWINGS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES, for submittal provisions and procedures.
- B. Shop Drawings shall be at 1/4" = 1'-0" scale and shall show the layout of all equipment, all plumbing, electrical, gas, water, ventilating and other service connections required. Submit 1/2"= 1'- 0" scale drawings for all fabricated or shop-made equipment. Submit detail drawings showing construction materials, dimensions, connections, locations of furring, blocking and hanging strips, locations and types of fasteners and all other necessary details.
- C. Submit a schedule of all sinks, fittings, equipment, appliances and accessories required under this Section.
- D. The exact location of all connections shall be dimensioned for all equipment and labeled with the necessary information. Obtain and verify all dimensions, measurements and conditions, and assume all responsibility in respect to same.

- E. No fabrication, shipment, or installation shall take place until Shop Drawings and manufacturers' cuts have been approved.
- F. Product Data: For each type of product indicated, including but not limited to cabinet hardware and accessories.

1.4 SAMPLES

- A. Submit samples of all materials requested by the Architect.
- B. Samples shall be prepared and submitted in accordance with requirements of Division 1.
- C. Solid Wood: 6" x 6" x 3/4" of each species and cut. Special millwork shapes and moldings: 12" length of each type.
- D. Plywood: 6" x 6" of each specified type and veneer.
- E. Particleboard: 8" x 10" of specified type.
- F. Plastic Laminate: Manufacturer's standard sample chain, in complete range of solid colors and in specified texture, for selection by the Architect.
- G. Casework Construction: Sample corner with top and other sections as requested. Submit full size base cabinet with drawer and door, including hardware and attachment devices.
- H. Cabinet Hardware: One unit of each type and finish.

1.5 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

- 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.
- D. Provide name, address and telephone number of the manufacturer's representative and service company for each piece of equipment so that service or spare parts can be readily obtained.

1.6 WARRANTY/GUARANTEE

- A. Attention is directed to provisions of the GENERAL CONDITIONS AND DIVISION 1 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 liability which 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 the final payment is made, a written guarantee covering the above equipment.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Protect casework during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
- B. Do not deliver casework until masonry, concrete work, plastering and similar wet operations which could damage, soil, or deteriorate casework have been completed in installation areas. If, due to unforeseen circumstances, casework must be stored in other than installation areas, store only in areas meeting requirements specified below for installation areas.

1.8 JOB CONDITIONS

- A. Advise Contractor of temperature and humidity requirements for casework installation. Do not install casework until required temperature and relative humidity have been stabilized and are maintained in installation area.
- B. Temperature and humidity in installation area shall be maintained as required to maintain moisture content of installed casework within 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

1.9 QUALIFICATIONS OF MANUFACTURER AND SUBCONTRACTOR

- A. The manufacturer of casework and related items shall submit written evidence that it is, and has been for at least ten (10) years, continuously engaged in the manufacture of the type of casework specified herein; and shall submit the names and addresses of at least five (5) projects of similar size and scope, where said casework has been in place for at least five (5) years.
- B. The casework Subcontractor shall submit written evidence of not less than five (5) years' experience in the application of the specified casework using the materials of the manufacturer proposed for this Project, including a statement from the manufacturer that the Subcontractor is certified by the manufacturer for the application of the specified casework materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Cabinetwork shall be square, flush overlay, wood construction with wood veneer faced door and drawer fronts with machine radius solid oak edge bands. All cabinets shall be constructed of Oak lumber using mortised and tendon, glued and screwed construction as

described herein. All cabinets shall be self-supporting, modular units to permit rearrangement in the future.

- B. All casework backs, whether exposed or unexposed, shall be constructed of one piece as far as possible. No visible joints shall be allowed. The use of honey comb or hollow core doors will not be accepted. The use of thin veneer strips as scribe molding (filler panels) stapled to cabinet ends shall not be acceptable. All scribe molding (filler panels) shall be 3/8" solid lumber properly fitted and nailed to cabinet ends. All exterior and interior surfaces shall be free of void, fills and patch marks.
- C. This reference is not intended to be restrictive or limiting to competitive manufacturers of comparable quality and design. Proposals using competitive specifications must submit sufficient illustrative material with their proposals to permit comparisons.

2.2 MANUFACTURERS

- A. Factory fabricated casework shall be as manufactured by:
 - 1. Campbell/Rhea, Mohon International, Inc., Paris, TN 38242
 - 2. Wood Metal Industries, Kreamer, Snyder Co., PA 17833
 - 3. Collegedale Casework, Inc., Collegedale, IN 37315
 - 4. Hamilton Industries, Two Rivers, WI 54241
 - 5. Approved equal.
- B. Casework components referred to under this Section are based upon casework as similarly manufactured by Campbell/Rhea, Mohon International, Inc. Style based on Campbell/Rhea's Signature Oak, using wood veneer including door and drawer fronts.
- C. All casework of other nationally recognized casework manufacturers shall be considered for approval provided that manufacturer's casework conforms to design, quality of materials, design intent, workmanship and exact performance function of casework components and details specified and implied by manufacturer's reference, and as shown on drawings.
- D. Manufacturers and their representatives shall show evidence of financial stability, plant facilities catalogs and specifications. Full-sized samples, catalogs and specifications, shall be submitted along with detailed list of deviations from these documents for approval. Samples may be impounded by Architect/Owner and retained until completion of job for verification and compliance of specifications.
- E. In addition to the above requirements, manufactures shall, at the same time, submit product test data, performed and certified by an independent testing agency, covering the following areas of product performance:
 - 1. Base cabinet construction/racking test.
 - 2. Wall cabinet construction/racking test.
 - 3. Cabinet corner/joinery strength test.
 - 4. Wall cabinet construction/static load test.
 - 5. Drawer corner/joinery strength test.
 - 6. Drawer construction/static load test.
 - 7. Cabinet adjustable shelf and support device/static load test.
 - 8. Cabinet interior, exterior and edging materials/acid resistance test.

2.3 MATERIALS

- A. Lumber:

1. Oak lumber shall be red oak, grade FAS or better, air-dried and kiln dried to 6% moisture content, then tempered in inside storage to a moisture content of 7-8% prior to fabrication. This moisture content shall be maintained throughout production. Red oak lumber exposed to view shall be carefully selected for color and grain, and shall be clear, sound, free from stains, voids, fills and patch marks.
 2. Direction of wood grain to be vertical on door, end panels unexposed backs; horizontal on drawer faces, aprons and top rails.
 3. Other hard woods shall be grade FAS or better, air dried to a 6 percent moisture content, then tempered to 7-8% prior to fabrication. Other hardwoods shall only be used unexposed, areas and comply with NHLA grading for FAS or better lumber.
- B. Plywood:
1. Oak plywood shall be red oak, grade A-2, plain sliced, book-matched, cross-banded, and shall have a solid core. The 3/4 inch red oak plywood is a minimum of 7-ply, 1/2 inch shall be minimum of 5-ply, 1/4 inch shall be a minimum of 3-ply, and 3/32 inch shall be 3-ply. Oak plywood shall be used for exterior surfaces exposed to view after installation, and the exposed interiors of open cases or cases having glazed doors.
 2. Other hardwood plywood shall be sound grade, have a solid core and be used only in unexposed areas. The 3/4 inch hardwood plywood shall be a minimum of 7-ply, 1/2 inch shall be a minimum of 5-ply, 1/4 inch shall be a minimum of 3-ply, and 3/32 shall be 3-ply. All interior plywood shall be free from voids, fills and patch marks.
- C. Hardboard: Hardboard shall be service tempered "Masonite", and consists of steam-exploded wood fibers, highly compressed into a hard, dense, 1/4 inch thick, homogeneous sheet, using natural resins and other added binders. Smooth on both sides. Physical properties: Average Modulus of Rupture to be 5,300 lbs/sq. inch, density shall be 50 to 60 lbs/cu. foot, tensile strength of 3,500 lbs. sq. inch.
- D. Glass:
1. DSB glass is double strength, grade "B", and 1/8 inch thick.
 2. Float glass shall be poured, clear glass, 1/4 inch thick, with a minimum of 88 percent clarity.
 3. Laminated safety glass shall consist of two outer piles of glass with a vinyl interlayer, and is either 7/32 inch or 1/4 inch thick.
 4. Tempered safety glass shall be specially heat treated glass, 1/4 inch thick with a minimum of 88 percent clarity.
- E. Plastic laminate:
1. High pressure plastic laminate shall be, regular grade in melamine impregnated decorative surface papers, superimposed over kraft phenolic core sheets, then bonded at pressures exceeding 1/2 ton per square inch while maintaining temperatures in excess of 280 degrees, F. After pressing, edges and ends are trimmed and the back side is sanded to facilitate bonding.
 2. Vertical grade, high pressure, plastic laminate shall have a minimum nominal thickness of .030 inches bonded with waterproof cement in hydraulic presses.
 3. Laminate manufacturers shall be equal to Formica, Nevamar, Pionite or Wilson Art. Contractor must offer a full range of color and patterns from the same.
 4. A minimum of five different colors and/or patterns shall be available..
- F. Particleboard: Industrial Grade, water-resistant, conforming to Commercial Standard CS236-66, Table 1, Classification 1-B-2; Federal Specifications LLL-B-800A, and ASTM D 1037-78; with a minimum density of 45 lbs./cu. ft.; internal bond of 80 psi; screw holding capability of 280 pounds for faces, surface hardness 900 lbs., and 225 pounds for edges; and machine sanded smooth on all faces. Modulus of elasticity, minimum, 450,000 psi. and modulus of rupture, minimum, 2,200 psi..

2.4 BASE, WALL, TALL CASEWORK COMPONENTS AND CONSTRUCTION

A. Base Cabinets Components:

1. Frame and rails:
 - a. Horizontal front top frame member: 1 inch by 2 1/4 inch, solid oak.
 - b. Horizontal rear top frame member: 1 inch by 2 3/4 inch, solid oak.
 - c. Front intermediate rails: 3/4 inch by 2 1/4 inch, solid oak.
 - d. All other frame members: 3/4 inch by 1 3/4 inch, solid hardwood.
2. Backs:
 - a. Exposed exterior backs: 3/4 inch oak plywood.
 - b. Cabinets with exposed interiors but unexposed exteriors: backs shall be 1/4 inch oak plywood.
 - c. Cabinets with unexposed interiors and exteriors: backs shall be 1/4 inch service tempered hardboard.
 - d. Cabinets wider than 36 inches shall have a center shelf support. Backs shall be 3/4 inch hardwood plywood.
3. End panels:
 - a. Cabinets with exposed interiors: end panels are 3/4 inch oak plywood.
 - b. Cabinets with exposed exteriors: end panels are 3/4 inch oak plywood.
 - c. Cabinets with unexposed interiors and one exposed end panel and one unexposed end panel: exposed end panel shall be 3/4 inch oak plywood and unexposed end panel shall be 3/4 inch hardwood plywood.
 - d. Cabinets with unexposed interiors and unexposed exteriors: end panels shall be 3/4 inch hardwood plywood.
4. Bottoms, shelves and dividers:
 - a. Cabinets with exposed interiors: all shall have 3/4 inch oak plywood, with 1 inch thick shelves for cases wider than 36 inches.
 - b. Cabinets with unexposed interiors: all shall have 3/4 inch hardwood plywood, with 1 inch thick shelves for cases wider than 36 inches.
 - c. Shelves 42 inches and longer shall be supported at the center by an additional shelf clip and shelves 48 inches and longer shall in addition have a full width metal angle stiffener.
5. Exposed edges of end panels, bottom, shelves, and dividers are edged-banded with 1/4 inch solid oak.
6. Drawer separators shall be furnished at all drawers with or without locks and shall be 1/4 inch service tempered hardwood.

- ### B. Base Cabinet Construction:
- All structural joints shall be mortised and tendon, glued and screwed. Base cabinets are rigidly constructed, integral units. Each base cabinet is completely enclosed without the use of common partitions, and shall be flush construction with overlapping doors and drawers, which provides a dust resistant and vermin free interior. A base cabinet shall have a full horizontal top frame with mortised and tendon joints, intermediate front and rear horizontal parting rails, as required; 3/4 inch plywood bottom, and dividers, as required. Horizontal top frame, intermediate parting rails and the bottom shall be tendon and let into routed end panels, then glued and fastened with countersunk screws. Backs shall be recessed and let into routed end panels, except where they need to be removable for access to plumbing, tamper proof screws shall be used. Backs shall be screwed to the top frame and bottom panel and further secured with glue blocks on each side. An enclosed toe space, 2 1/4 inches by 4 inches shall be provided with the toe rail screwed to end and bottom panel. Separators where indicated, shall be let into routed intermediate rails and end panels. Cabinets with sliding doors shall have 1/4 inch solid oak molding on the front interior, vertical edge of end panels, providing a dust strip for sliding doors. Adjustable shelves shall be supported on heavy-duty, plastic coated, brass plated steel shelf clips, which shall fit into holes drilled 32 mm on centers, in the cabinet end panels. Base cabinets 42 inches wide and wider shall have additional holes drilled 32 mm

on centers in back panel for additional shelf clips to support shelves. All fastening hardware (screws, bolts etc.) shall be attached in a neat and orderly fashion using the same type of fasteners throughout the project for the same type of application.

C. Wall and Upper Case Components:

1. Front rails: top and bottom shall be 2-1/4 inches by 3/4 inch, solid oak.
2. Top panel, bottom panel, adjustable shelves:
 - a. Cases with exposed interiors: all shall be 3/4 inch, oak plywood, with 1 inch thick shelves for cases 42 inches wide and wider.
 - b. Cases with unexposed interiors: all, except bottom, shall be 3/4 inch, hardwood plywood, with 1 inch thick shelves for cases 42 inches wide and wider.
 - c. Case bottoms shall be 3/4 inch oak plywood.
 - d. Shelves 42 inches and longer shall be supported at the center by an additional shelf clip and shelves 48 inches and longer shall in addition have a full width metal angle stiffener.
3. Backs:
 - a. Cases with exposed interiors and exposed exterior backs: backs shall be 1/4 inch oak plywood.
 - b. Cases with unexposed interiors and exteriors: backs shall be 1/4 inch service tempered hardboard.
 - c. Cabinets wider than 36 inches shall have a center shelf support. Backs shall be 3/4 inch hardwood plywood.
4. End panels:
 - a. Cases with exposed interiors: end panels are 3/4 inch oak plywood.
 - b. Cases with exposed exteriors: end panels are 3/4 inch oak plywood.
 - c. Cases with unexposed interiors and one exposed end panel and one unexposed end panel: exposed end panel shall be 3/4 inch oak plywood and unexposed end panel shall be 3/4 inch hardwood plywood.
 - d. Cases with unexposed interiors and unexposed exteriors: end panels shall be 3/4 inch hardwood plywood.
5. Exposed edges of end panels, shelves, and dividers are edged-banded with 1/4 inch solid oak.
6. Exterior hanger rails: 3 inch by 3/4 inch hardwood plywood.
7. Fascia: 4 inch by 3/4 inch hardwood plywood to match top edge.

- D. Wall and Upper Case Construction: All structural joints shall be mortised and tendon, glued and screwed. Wall and upper cases shall be rigidly constructed, integral units. Each case shall be completely enclosed without the use of common partitions, and shall be flush construction with overlapping doors, which provides a dust resistant and vermin free interior. Top panel shall be tendon and let into routed end panels; lapped, glued and screwed to front top rail; and glued and screwed to each end panel and the back. Bottom panel shall be tendon and let into routed end-panels; lapped glued and screwed in to front bottom rail; and glued and screwed to each end panel and the back. Backs shall be recessed and let into routed end panels, and further secured with glue blocks on each side. Exterior hanger rails, at the top of the back, shall be glued to the back and then screwed to the top panel and end panels. Exterior hanger rails, at the bottom of the back, shall be glued to the back and then screwed to the bottom panel and end-panels. Cases with sliding doors have 1/4 inch solid oak molding on the front interior, vertical edge of end panels, providing a dust strip for sliding doors. Adjustable shelves shall be supported on heavy-duty, plastic coated, brass plated steel shelf clips, which shall fit into holes drilled 32 mm on centers, in the cabinet end panels. Wall and upper cabinets wider than 36 inches shall have additional holes drilled 32 mm on centers in back panel for additional shelf clips to support shelves. All fastening hardware (screws, bolts etc.) shall be attached in a neat and orderly fashion using the same type of fasteners throughout the project for the same type of application.

- E. Tall Case Components:
1. Top front rail: 2-1/4 inches by 3/4 inch, solid oak.
 2. Top panel, bottom panel, dividers, fixed and adjustable shelves:
 - a. Cases with exposed interiors: all shall be 3/4 inch, oak plywood, with 1 inch thick shelves for cases 42 inches wide and wider.
 - b. Cases with unexposed interiors: all shall be 3/4 inch, hardwood plywood, with 1 inch thick shelves for cases 42 inches wide and wider.
 - c. Shelves 42 inches and longer shall be supported at the center by an additional shelf clip and shelves 48 inches and longer shall in addition have a full width metal angle stiffener.
 3. Backs:
 - a. Cases with exposed interiors and exposed exteriors: backs shall be 1/4 inch oak plywood.
 - b. Cases with exposed interiors and exposed exteriors: backs shall be 3/4 inch oak plywood if wider than 36 inches.
 - c. Cases with unexposed interiors and exteriors: backs shall be 1/4 inch service tempered hardboard.
 - d. Cases wider than 36 inches shall have a center shelf support. Backs shall be 3/4 inch hardwood plywood.
 4. End panels:
 - a. Cases with exposed interiors: end panels are 3/4 inch oak plywood.
 - b. Cases with exposed exteriors: end panels are 3/4 inch oak plywood.
 - c. Cases with unexposed interiors and one exposed end panel and one unexposed end panel: exposed end panel shall be 3/4 inch oak plywood and unexposed end panel shall be 3/4 inch hardwood plywood.
 - d. Cases with unexposed interiors and unexposed exteriors: end panels shall be 3/4 inch hardwood plywood.
 5. Exposed edges of end panels, shelves, and dividers are edged-banded with 1/4 inch solid oak. Shelves shall be 3/4" thick oak plywood, faced with 1" x 3/4" solid oak where exposed.
 6. Exterior hanger rails: 3 inch by 3/4 inch hardwood plywood.
 7. Fascia: 4 inch by 3/4 inch hardwood plywood to match top edge.
- F. Tall Case Construction: All structural joints shall be mortised and tendon, glued and screwed. Tall cases are rigidly constructed, integral units. Each case shall be completely enclosed without the use of common partitions, and shall be flush construction with overlapping doors and drawers, which provides a dust resistant and vermin free interior. Top and bottom panels and fixed center shelf shall be tendon, and let into routed end panels. Top panel shall be lapped, glued and screwed to front top rail; tip panel, fixed shelf and bottom panel shall be glued and screwed to the end panel and the back. An exterior back cross rail shall be provided at the top of each case, glued to the back, and then screwed to the top panel and the end panels. Additional back cross rails shall be provided , as required. Backs shall be recessed, let into routed end panels, and further secured with glue blocks at the sides. A totally enclosed toe space, 2 1/4 inches by 4 inches high, shall be provided with toe rail securely screwed to end panels and bottom panel. Cases with sliding doors shall have 1/4 inch solid oak molding on the front interior, vertical edge of end panels, providing a dust strip for sliding doors. Adjustable shelves shall be supported on heavy-duty, plastic coated, brass plated steel shelf clips, which shall fit into holes drilled 32 mm on centers, in the cabinet end panels. Tall cases wider than 36 inches shall have additional holes drilled 32 mm on centers in back panel for additional shelf clips to support shelves. All fastening hardware (screws, bolts etc.) shall be attached in a neat and orderly fashion using the same type of fasteners throughout the project for the same type of application.
- G. Drawer Components:

1. Drawer front: 13/16 inch solid core lumber. Exposed face of the drawer shall have wood veneer.
 2. Drawer box: front, sides and back, 1/2 inch hardwood lumber.
 3. Drawer bottom: 1/4 inch service tempered hardwood.
- H. Drawer Construction: Drawer front overlaps the opening 1/4 inch on all sides. The edges shall be mitered 1/4" to expose the solid oak edges which shall be stained and finished to match the casework. Drawers shall be box type with an applied drawer front securely screwed to the box. The top edge of the drawer box front, sides and back are radius. Sides, back and front of the box have corners that are dovetailed and glued. The bottom is let into the box on four sides and securely glued underneath with a continuous bead of glue around the perimeter of the drawer bottom. In cabinets 24 inches or less in width, drawers shall have one pull, which is attached with 2 screws, 3-3/4 inches on centers. Cabinets over 24 inches wide, drawers shall have two pulls. Drawers shall be supported on side mounted; heavy duty slides, zinc plated, cold rolled steel, and have a 100 lb. load capacity. Slides shall be equipped with heavy-duty, ball bearing nylon rollers for smooth effortless operation. Slides shall have automatic, positive stop levers to prevent drawer's accidental removal, but allow for quick removal without tools. File drawers shall be supported with side mounted, full extension steel slides. File drawers shall have an interior, screw mounted, metal bottom track to allow for hanging folders and an adjustable metal file follower.
- I. Hinged solid doors, 48 inches or less in height:
1. Core ply: Solid oak rails on four edges framing a particle board core.
 2. Veneer: Wood veneer applied to each side of the core.
- J. Construction of Hinged Solid Doors, 48 Inches Or Less In Height: Shall be 13/16 inch thick overlapping cabinet 1/4 inch on all sides. The edges shall be mitered 1/4" to expose the solid oak rails which shall be then stained and finished to match casework. The left door of double doors shall have center machined astragal. Doors shall be guaranteed against warping, sagging and binding. Door shall have two heavy duty, institutional type, 5-knuckle hospital tipped hinges; each attached with 5 tempered steel screws into solid oak framing of the door, and 4 Euro screws into the end panel. Doors shall be secured by a zinc plated steel, friction roller catch, with a positive action, spring cushioned, polyethylene roller, and metal strike plate. Catch and strike plate shall be mounted with screws. The left door of a double door shall be secured with steel, spring loaded, elbow catch that releases with finger pressure. The catch and steel strike plate shall be mounted with screws. Strike plate screw holes shall be slotted for adjustability and a pin hole shall be provided to help anchor its position.
- K. Hinged solid doors, over 48 inches in height:
1. Core ply: Solid oak rails on four edges framing a particle board core.
 2. Hardwood plywood 3-ply, 3/32 inch thick: Two; one laminated on each side of the core ply.
 3. Veneer: Wood veneer applied to each side of the core.
- L. Construction of Hinged Solid Doors, over 48 Inches or More in Height: Shall be 1-1/16 inch thick and have solid oak rails on the four edges. Doors shall overlap cabinet 1/4 inch on all sides. The edges shall be mitered 1/4" to expose the solid oak rails which shall be then stained and finished to match casework. Single doors and right door of double doors shall have latching handle, which shall be 4-1/4 inches long, streamline design, with a dull chrome plated finish. Handle shall operate with 1/4 turn. Left door of double doors shall have dummy handle, which shall be same size and finish as latching handle. A three point latching system shall be provided to right door of double doors and single doors providing positive engagement at the top, bottom of door with tapered aluminum rods which engage plastic strike plates and pull the door snug. The rods shall be 5/16 inch in diameter and

move in nylon glides attached to back of the door. The middle of the door shall be secured by a latch plate which engages the sides of the case, or latches behind the left door on cases with double doors. Right door of double doors lapped over the machined astragal on left door, securely holding door shut. Doors shall have four chrome plated, heavy duty, institutional type, 5-knuckle hospital tipped hinges; each attached with 5 tempered steel screws into solid oak framing of the door, and 4 Euro screws into the end panel. Left door of double doors shall be additionally secured with two magnetic catches that have a 12 to 19 lb. rated pull. Catches and steel strike plates are attached with screws. Catch screw holes shall be slotted for adjustability, and the strike plate shall have two nips to help anchor its position. Locking handle shall have same finish.

- M. Hinged Glazed doors, 48 Inches Or Less In Height:
1. Components:
 - a. Frame: Solid Oak rails 1 1/16 inch by 3 inch wide, solid oak.
 - b. Glass: 1/8 inch DSB glass.
- N. Construction: Glazed doors frame shall be joint mortised and tendon, glued and screwed, and shall be 13/16 inch thick overlapping cabinet 1/4 inch on all sides. The edges shall be mitered 1/4" to expose the solid oak rails which shall be then stained and finished to match casework. The balance of the door is glass. The back perimeter of the door shall be routed so the door projects 13/32 of an inch. The left door of double doors shall have a center machined astragal. Doors shall be guaranteed against warping, sagging and binding. Door shall have two heavy duty, institutional type, 5-knuckle hospital tipped hinges; each attached with 3 tempered steel screws into solid oak framing of the door, and 3 Euro screws into the end panel. Finish Architects choice. Doors shall be secured by a zinc plated steel, friction roller catch, with a positive action, spring cushioned, polyethylene roller, and metal strike plate. Catch and strike plate shall be mounted with screws. The left door of a double door shall be secured with steel, spring loaded, elbow catch that releases with finger pressure. The catch and steel strike plate shall be mounted with screws. Strike plate screw holes shall be slotted for adjustability and a pin hole shall be provided to help anchor plate position.
- O. Apron Frame Sections (AFS):
1. Components:
 - a. Exterior rails. All apron rails shall be 4"H x 3/4 inch thick hardwood with bottom edge radiuses 1/4 inch and top edge grooved for securing top fasteners Front apron rail shall be routed from 4 inches to 1-1/2 inches high starting 3 inches from center line of each leg to allow for maximum knee pace to meet ADA recommended dimensions..
 - b. Exterior rails with drawers: 5 1/2 inch by 3/4 inch, solid oak.
 - c. Interior rails: 3/4 inch solid hardwood; 3/4inch solid oak if visible.
 - d. Compartment bottoms: 1/4 inch oak plywood.
 - e. Legs: 2 1/2 inch square laminate solid oak. Counter legs shall be bolted to the floor
 - f. Leg stretcher: 2 inch square laminated solid oak, positioned between each pair of legs going the width of each free standing table.
 2. Construction: Exterior table rails shall be one piece (no edge gluing) solid oak. Openings shall be routed in the one piece rail when drawers or compartments are required. A minimum of two interior cross rails shall be mortised and tendon, glued and stapled into exterior rails. Compartment bottoms shall be let into grooves in cross rails and the front rail, then glued and stapled to the compartment back. Exterior rails shall be grooved at corners to receive heavy steel corner braces, attached with screws. Legs shall be secured to the steel corner brace and table rails with 5/16 inch treaded hanger bolt; machine screwed into the leg a depth of at least 2 inches. Legs shall have molded black polyethylene, closed bottom, leg shoes. All legs shall be provided with leveling floor glides. Exterior rails shall also be grooved to accept "Z"

clips for attaching the top. Sections over 48 inches wide shall have a "V" shape steel keel with flanges screwed into the underside of counter top. Keel shall be secured with particleboard 6inch screws on center both sides.

2.5 HARDWARE, TRIM AND ACCESSORIES

- A. All hardware components shall meet ADA (American with Disabilities Act) requirements. It is the responsibility of this Equipment Contractor to become familiar with such regulations, and provide products which meet or exceed such requirements.
- B. Pulls: Shall be of modern wire pull design, except as indicated on Drawings. Pulls shall attach to drawer or door with machine screws on 4" centers. Finish shall be extruded aluminum with satin anodized lacquer finish. Color Architect's choice.
- C. Hinges: Hinges shall be steel, 2-1/2", five-knuckle, wrap-around institutional type heavy-duty with offset wings designed to locate hinged side door at 7/16" from cabinet end. Hinges shall be mounted to door and case with nine (9) #7 flat head screws per hinge. Doors 48" in height and over shall be fitted with three (3) hinges per door. Doors 82" in height and over shall be fitted with four (4) hinges per door. Hinge shall allow 270 degree swing. Finish shall be as selected by Architect.
- D. Locks: Locks shall be applied to all base and wall cabinet doors and drawers as indicated on the drawings and/or casework unit schedule. Keying systems shall be National Lock (Campbell/Rhea SL-1) or equal. Locks shall be laboratory grade, cylinder cam lock, with a 5-disc tumbler mechanism, and dull chrome plated face. Tumblers and keys shall be brass, while plug and cylinder shall be die cast zinc alloy. A 180-degree turn of the key moves the lock cam into, or out of, a slot cut to receive it. The lock system shall restrict duplicating of keys to registered locksmiths. Exposed surface of locks shall match other cabinet hardware trim.
 - 1. Keying Requirements: There shall be 500 key changes standard. All Locks with in each room shall be keyed alike except wardrobe units, which shall be keyed differently and furnish two (2) keys with each lock. Locks and corresponding keys are alpha-numerically coded for a quick match. Lock shall have "Removal Core" keying control. If needed, with the use of a control key, the key core of the lock assembly can be removed and a new key core inserted, changing the entire locking system in a matter of minutes. Key cores shall be held out of the lock assembly until the project is completed, removing the security risk of lost or stolen keys during installation and construction. Casework installers shall install key cores just prior to the on set of the Architect's review of punch items and substantial completion of construction. The Casework manufacturer shall provide control keys and replacement cores as required. Minimum five (5) sets of master keys shall be furnished to Owner which will operate all locks including latching handles.
 - a. Hinged doors and drawers National Lock No. MA-7054 or equal
 - b. Sliding doors, 13/16 inch thick, National Lock No. MA-0057 or equal
 - c. 1/4 inch sliding panels doors, National Lock No. C8741.26 or equal.
- E. Tall Cabinet Handles: Provide a latching handle on all tall cabinets with a lock mechanism incorporated into the handle head (Campbell/Rhea LK-1). Handles shall be a die cast zinc alloys, 4-1/4 inches long streamline in design, and has dull chrome plated finish. Handle operates with 1/4 turn. Double door cases have latching handles on the right door and dummy handles on the left door. A three point latching system provides a positive engagement at the top and bottom of the door with tapered aluminum rods which pull the doors snug when they engage plastic strikes. The rods are 5/16 inch in diameter and move in nylon guides attached to the back of the door. The middle of the door is secured by a

latch plate, which engages the side of the case. Or latches behind the left door on cases with double doors. Latching handles shall be furnished with two (2) keys. See 2.05.D.1 above for keying requirements. Locks shall be laboratory grade, cylinder cam lock, with a 5-disc tumbler mechanism. Tumblers and keys shall be brass, while plug and cylinder shall be die cast zinc alloy. Three-point latch plates shall provide positive engagement at top, bottom of case. Two 5/16" diameter aluminum rods extending full height of case shall latch behind adjustable plastic strikes at top and bottom of case, and the latch plate at the center of the door shall engage the side of case or latch behind adjacent door on double-door cases. Provide nylon guides for the aluminum rods at top and bottom of doors.

1. Locking Handle: #M4-0340-428 (National Cabinet Lock)
2. Dummy Handle: #M6-0342-001
3. Latch Plate: #M3-6915-005

F. Catches:

1. Friction roller catch is zinc plated steel with positive action spring cushioned,
2. Polyethylene roller and a metal strike plate. Screw mounted catch and strike plate shall have slotted holes for adjustability.
3. Elbow Catch shall be steel, spring loaded catch that releases with finger pressure. The catch and steel strike plate shall be mounted with screws. Strike plate screw holes shall be slotted for adjustability and pin hole shall be provided to help anchor its position.

G. Drawer Slides:

1. Drawer slides: shall be steel-epoxy coated or equal. Each slide shall be in two (2) sections with a load capacity of 100 pounds per pair. Slides shall provide a positive closing position, and positive stop in extended position. Knappe & Vogt #1284
2. File drawer slides: shall be steel-epoxy coated or equal. Providing a minimum of 100 pound load capacity and incorporating positive stop. Knappe & Vogt #8400
3. File drawer accessory: follower and track, Knappe & Vogt No. 476/476F

H. Hanging File Rails: File drawer hanging rails shall be aluminum and anodized. Hafele 422.71.303 or approved equal.

I. Shelf Clips: Clips shall be made from steel, then brass plated after fabrication. Clips are angle type with a 1/4 inch diameter, 3/8 inch long stud which fits into holes drilled 32 mm on center in end panels. The 3/4 inch long ledge is dipped in a non-slip plastic coating, and has a predrilled hole to anchor shelf to the clip.

J. Door Chain-stops: Chain-stops shall be provided at all cabinet doors on base, wall or full height units where doors come in contact with either an adjacent wall and/or other protruding objects including adjacent countertops.

K. Tag Holders: shall be nickel plated. Tag holders on:

1. File Cabinets: 93mm x 41mm, Hafele #168-02-770 or equal

L. Wardrobe Rod and Flanges: to be 1 1/16 inch chrome rod supported by chrome flanges.

1. Rod: Knappe & Vogt #750 1
2. Flange: Knappe & Vogt #632

M. Coat Hooks: Single coat hooks, rail mounted, button style, 1 3/8" diameter, satin stainless steel, include mounting hardware. Series CH23 by Doug Mockett and Co. or equal.

N. Grommet: For wire management slot shall be 3" x 6-1/2" large oval-lipped polyethylene plastic. Insert liner shall cover the depth of counter and counter substrate if required.

Grommet shall be glued. Color to be selected by Architect. Series LO by Doug Mockett and Co. or equal.

- O. Pegboards/Drip Trough: Pegboard shall be 1" thick epoxy resin with polypropylene pegs. Provide each pegboard with 22 gauge stainless steel drip trough with a 3/8" OD long copper drain stub.
- P. Rod sockets shall be mushroom type, machined from a solid aluminum rod. Sockets shall be held in place by a heavy aluminum lock nut and washer.
- Q. Burette rods shall be 1/2-inch diameter, anodized aluminum, and either 18 or 24 inches long. Rods shall be furnished with a tapered aluminum adapter to fit rod socket.
- R. Clamps shall be 1-inch square aluminum stock, with two, 3/4-inch diameter openings, at right angles to each other, bored through sides. Openings shall be for upright rods and crossbars, or Greenlaw Arms. Thumb screw into each end of the clamp; tighten against the rods to hold positions.
- S. Crossbars and Greenlaw Arms shall be 3/4-inch diameter, anodized aluminum rods, with ends rounded.
- T. Leg shoes shall be closed-bottom style, 2-1/4 inches square, and molded of 1/8 inch black polyethylene.
- U. Linear Bar Diffuser at Toe Kick: (Titus, CT-PP-O or equal) Shall be continuous, pencil proof, linear bar diffuser constructed of extruded aluminum with 7/32" bars at 7/16" on center, support bar, and 0 degree deflection. Linear Bar Diffuser at Countertop: (Titus, CT-PP-O, border type 12, fastener type C or equal) Shall be continuous, pencil proof, linear bar diffuser constructed of extruded aluminum with 7/32" bars at 7/16" on center, support bar, and 0 degree deflection.
- V. 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.

2.6 SINKS, GENERAL

- A. General: Sinks, General: Provide sizes indicated or manufactured casework manufacturer's closest standard size of equal or greater volume, as approved by Architect. All sinks and fittings shall meet the requirements for plumbing fixtures and fittings as specified in Division 22 – 23, PLUMBING
- B. Epoxy Resin Sinks:
 - 1. Material: Match epoxy resin countertop material.
 - 2. Sink Fabrication: Molded in 1 piece with smooth surfaces, coved corners, and bottom sloped to outlet; 1/2-inch minimum thickness.
 - a. Provide integral sinks in epoxy countertops, bonded to countertops with invisible joint line.

2.7 PLUMBING FITTINGS

- A. General: Provide fittings from a single manufacturer where possible. All fittings shall be as approved by and coordinated with sink manufacturer and the work of Division 22 - 23, PLUMBING.
- B. Service Fittings: Provide units that comply with SEFA 7, "Laboratory and Hospital Fixtures-- Recommended Practices." Provide fittings complete with washers, locknuts, nipples, and other installation accessories. Include wall and deck flanges, escutcheons, handle extension rods, and similar items.
 - 1. Provide units that comply with recommendations in SEFA 7, Section 11, "Vandal-Resistant Faucets and Fixtures."
- C. Materials: Fabricated from cast or forged red brass, unless otherwise indicated.
- D. Finish: Chromium plated.
- E. Water Valves and Faucets: Provide units complying with ASME A112.18.1, with renewable seats, designed for working pressure up to 80 psig (550 kPa).
 - 1. Vacuum Breakers: Provide ASSE 1035 vacuum breakers on water fittings with serrated outlets.
- F. Gas/Compressed Air Fittings:
 - 1. Services: Gas (fuel gas) or Compressed Air
 - 2. Type of Fitting: Deck-mounted, combination valve and turret product, complete with inlet shank.
 - 3. Outlets: One or Two (at 90 degrees) as indicated on drawings and/or fixture schedule.
 - 4. Outlet Type: Straight, with removable serrated lab hose nozzle and integral check valve.
 - 5. Valve Type: Ball valve.
 - 6. Construction: Solid brass with high-gloss polished chrome finish
 - 7. Product: Chicago Faucet Co., 982-WS-909C with index for Gas, or equal.
- G. Laboratory Emergency Shower/Eyewash:
 - 1. Provide where indicated, horizontally mounted emergency shower with heavy duty aluminum pull rod. Shower shall have stainless steel actuating arm with a 1" IPS chrome plated brass stay-open ball valve and ABS plastic shower head. Deck mounted eye wash shall have two gentle spray outlet heads, recessed stainless steel bowl and deck mounted stay-open ball valve. Each spray head shall have removable ABS plastic spray cover, reticulated polyurethane filter, self-regulating flow control and integral "flip-top" dust cover. Provide shower/eyewash complete with all mounting hardware.
- H. Water Distiller:
 - 1. Provide Water Distiller as manufactured by Barnstead or equal where indicated on drawings. Provide with one liter bottle and all required hardware and accessories to make unit fully operational.

2.8 ELECTRICAL FITTINGS

- A. Casework-Mounted Electrical Receptacles: Duplex and/or Quad electrical receptacles in compliance with the electrical requirements of Division 26 – ELECTRICAL.

2.9 COUNTERTOPS

- A. Standard countertops shall be 1-1/4" thick with 4" high backsplash, unless otherwise indicated, and of material and construction the same or equal to that specified below. Laboratory tops shall be in as large pieces as possible, complete with drip grooves machined into underside of perimeter edges. Joints shall be sealed with catalytic epoxy resin cement in all laboratory or wet areas.
- B. Plastic Laminated Countertops: Plastic laminated countertops shall be factory-fabricated of general purpose .050" thick high-pressure plastic laminated meeting NFMA LD3-1995 equal to Formica, Nevamar, Pionite or Wilson Art sheets bonded with waterproof cement in hydraulic presses to a seven-ply, close-grain veneer 3/4" thick. A wood frame 7/16" thick x 5" wide shall be glued to the underside of the table top at the counter perimeter and at all sink openings. Overall finished thickness of tops shall be 1-1/4". The underside of all plastic laminated tops shall be sealed with .020" phenolic plastic backer sheet glued up same as top surface. Exposed counter edges and back-splash edges shall be self-edge. Laminate colors and patterns shall be as selected by the Architect from manufacturer's full range of Formica, Nevamar, or Wilson Art.
- C. Laboratory Tops/Backsplash/Returns
 - 1. Epoxy Resin Tops and Backsplash: one inch thick, molded epoxy resin and shall have optimum physical and chemical resistance. The specially compounded and cured uniform mixture, throughout the thickness of the top, will not dependent on a surface coating for chemical or stain resistance. Exposed edges and corners are radiused, and a drip groove is provided under surface in areas where sinks are installed.

2.10 FUME HOODS

- A. This specification covers the requirements of bench-mounted high performance laboratory fume hoods for remote exhaust blower systems, with the airflow design, by-pass design and service fixture configurations that are required on these hoods and as manufactured by Labconco Corporation, 8811 Prospect Avenue, Kansas City, Missouri 64132, Protector XStream Laboratory Hoods or equal.
- B. Laboratory hoods are of double-wall construction with epoxy-coated, cold rolled steel exterior, galvanized steel supports, 3/16" sheet molded composite board internal liner, and perforated primary baffle designed to pull air in horizontal streams to minimize the air roll pattern associated with traditional fume hoods. A secondary baffle is located behind the primary perforated baffle to counteract upward air streams that produce roll. No moving parts are required for the down flow baffle system. The single 3/16" thick sash is vertical-rising from closed to 18" high at the sash stop and 28" fully open. Viewing height is 32.15". Hood incorporates a perforated sash handle to bleed air into the hood chamber directing fume concentrations away from the user's breathing zone. Hoods are provided with a perforated air foil across the bottom of the sash area to allow airflow into the hood regardless of user's position. Hoods are provided with an upper dilution air supply for by-pass air to bathe the sash interior and upper interior and to provide 5-10% of the hood's air volume requirements. Besides the exhaust blower, no additional blowers are required for operation. Access for maintenance is from both the front and interior sides of the hood. All hood-mounted service fixtures, where provided, are pre-plumbed except for the inlet tubing. All electrical services are pre-wired to a single point internal junction box at the top right of the hood. Hood is one-piece construction. Hoods without service fixtures pass through a 40" opening without disassembly.

- C. The hood manufacturer shall maintain a testing facility at its place of business for the testing of bench-mounted laboratory hoods in accordance with ASHRAE Standard 110-95. Both hoods and installation are in conformance to good construction practice and approved by the owner/user. Only hood manufacturers who have had fume hoods as a principal product for ten years are considered. The hood manufacturer's manufacturing and test facilities and its quality control procedures must be available for owner/user inspection.
- D. The laboratory hoods shall conform to the following regulations and standards:
 - 1. SEFA - #1 (Laboratory Fume Hoods)
 - 2. NFPA - #45 (Fire Protection for Laboratories Using Chemicals 2000) section 6-1 through 6-14
 - 3. ASTM-E-84 - Surface Burning Characteristics of Building Materials
 - 4. ASHRAE - 110-95 (Method of Testing Performance of Laboratory Fume Hoods)
 - 5. ANSI - Std. Z 9.5 (Laboratory Ventilation)
 - 6. UL Standard 3101 (Electrical Wiring)
 - 7. UL-1805 (Hood Construction)
 - 8. CAN/CSA Standard C22.2 No. 1010.1
- E. Materials
 - 1. Hood exterior construction shall be 20-gauge (or heavier) cold rolled sheet steel. Galvanized steel acts as external supports. All exterior painted surfaces are baked on dry powder epoxy applied electrostatically. Base metal material is properly prepared for epoxy coating.
 - 2. Hood interior liner and baffle shall be sheet molded homogenous polyester panels. Baffle requires chemically-resistant, epoxy-coated stainless steel brackets for support. Minimum thickness is 3/16". Flame spread is less than or equal to 25 per ASTM E-84.
 - 3. Corner posts shall be 16-gauge cold-rolled steel with epoxy-coated finish.
 - 4. Exhaust connection(s) shall be epoxy-coated 316 stainless steel.
 - 5. Optional rear exterior finish panel shall be epoxy-coated steel (consult Labconco).
 - 6. Hose connectors shall be chemically-resistant, glass-filled polypropylene with 6 serrations.
 - 7. Hood sash shall be 3/16" thick tempered safety glass with an epoxy-coated aluminum sash handle.
 - 8. The sash tracks shall be epoxy-coated steel.
 - 9. Hood service fixtures (on models with service fixtures) shall feature 1/4" copper tubing with extruded brass valve and rotating seat, TFE-coated silicone bronze stem and TFE packing. Gas valves feature brass service lines. Optional gooseneck service fixtures feature 3/8" copper tubing. Service fixtures do not include inlet tubing.
 - 10. Sash foil shall be 18-gauge epoxy-coated cold-rolled steel and have 10 rows of perforations.
 - 11. Upper dilution air supply shall be constructed from chemically-resistant, powder-coated steel.
 - 12. The bench-mounted laboratory hood with by-pass design shall minimize face velocity fluctuations as the sash is raised or lowered. With the sash positioned six inches above the air foil, the average inflow velocity won't be less than twice the selected full open face velocity nor greater than three times that amount.
 - 13. Corner posts shall be pre-punched and plugged to accommodate up to 4 service fixtures and 2 electrical receptacle boxes on each side. Right-hand corner post have ADA-compliant light and blower switches.
 - 14. Interchangeable removable side panels and removable front panels shall provide access to plumbing fixtures, electrical wiring, counterbalance sash weights, and lighting fixtures, where specified on the individual hoods. All services shall be accessible from the front of the hood. Interior access panels, one on each side, provide additional access.

15. The perforated air foils shall be directly across the bottom of the sash opening to allow the air to bypass underneath and through the foil and sweep across the work surface to prevent any back flow of fumes escaping from the front of the hood. The foil shall be at least 4" wide and extend back under the sash to prevent closure of the lower by-pass opening when the sash is in the fully closed position. The air foil has a large aerodynamic radius to sweep the air into the hood with minimal turbulence and perforated to pull inflow air from beneath so that clean air continually flows over the foil creating a constant protective barrier from contaminants. This airflow continues even if blocked by the presence of the operator.
16. The front and side exterior of the hood shall features baked on powder epoxy paint applied electrostatically.
17. The interior liner and baffle(s) shall be cut to fit in terms of size and securely held in place. The baffle(s) provides uniform draw throughout the fume cavity. The hood includes a two-baffle system. The first or primary baffle has multiple horizontal slots and directs the air to be exhausted in a non-turbulent/laminar flow stream from the hood face into the baffle in a single pass. The secondary baffle, located between the primary baffle and the back wall of the hood, neutralizes any upward air streams and reduce air stream roll. Baffles are removable for cleaning. No moving parts are required for high performance airflow.
18. Hoods shall have a single vertical sash counterbalanced by a single weight. The sash operates smoothly without tilting when raised or lowered from either end and remains at rest in any open position. All sashes are framed with extruded epoxy-coated aluminum and PVC. The full sash opening height is 28"; the total viewing area height is 32.15". The sash handle includes a perforated air passage directly atop the handle to bleed air into the hood chamber and direct chemical fumes away from the user's breathing zone. The handle is ergonomic in design and is easy to grasp when operating.
19. The hood shall incorporate an upper dilution air supply system. This system is mounted above and behind the sash and introduces between 5 and 10% of the required hood air volume. This device bathes the sash interior above the work area to eliminate chemical fumes along the sash plane near the operator's critical breathing zone.
20. The hoods shall be provided with a total of up to 8 service fixtures as required capable of providing hot and cold tap water (flow rate 3.5 GPM or 13.25 LPM at 67 psi at full open, 3.5 turns), natural gas (theoretical flow rate of 71CFM at 100 psi, provides 1095 BTU/Sec at a density of .667 Lbs/CU. FT.), air (theoretical flow rate of 59 CFM at 100psi), vacuum (theoretical flow rate of 6 CFM at 10 psi), nitrogen, argon and low pressure steam. Fixtures aerated at maximum pressure of 200 psi with a working pressure of 125 psi. Coefficient of flow for the valve, $C_v=0.43$. Services are provided through remote-controlled valves and 6-serration hose connectors located inside the fume hood cavity. Services are pre-plumbed except for the inlet tubing using 1/4" copper tubing except for the upper right hand fixture which is 1/4" brass for use with gas. Fixture handles are plastic and color coded as well as labeled for the designated type of service.
21. Vapor-proof hood models shall be provided with high-efficiency, quick-start, T8 fluorescent lighting systems (bulbs included) located behind a laminated safety glass shield on top of the hood liner. The fluorescent light assemblies shall be serviceable from outside the fume hood cavity. Hoods shall be provided with a light switch, blower switch, and all internal wiring to a single point internal junction box.
22. Provide each hood with epoxy resin work surfaces with a 1" leading edge and 6" x 3" oval epoxy cup sink w/1-1/2" drain connection, remote controlled cold water facet, remote controlled single gas fixture and base cabinets as shown on drawings.
23. Provide each hood with face velocity alarms to monitor hood performance.

2.11 APPLIANCES

- A. General: Provide appliances in quantities and locations as shown on the Fixed Casework Drawings elevations equal to or exceeding the quality and function described in this Section.
1. Under Counter Refrigerator: GE Spacemaker 4.3 Cu. Ft. – Model: GMR04BANBB, Color: Black on Black.
 2. Full Size Refrigerator: GE Energy Star 20.2 Cu. Ft. Bottom-Freezer Door – Model: GDSC0KCX, Color: Black on Black.
 3. Dishwasher: GE Tall Tub Built-In – Model: GLD6800NBB, Color: Black on Black.
 4. Washer/Dryer: GE 27" Unitized Spacemaker – Model: WSM2700HBB, Color: Black on Black. (Electric).
 5. Wall Oven: GE 24" Built-in Single – Model: JRP20WJBB, Color: Black on Black. (Electric).
 6. Microwave Oven: GE Spacemaker Grilling-Over-the-Range - Model: JVM1665DNBB, Color: Black.
 7. Cooktop: GE 30" Built-In Electric – Model: JP328WKBB, Color: Black on Black.
 8. Ice Machine: ICE o-Matic – Model: ICE0a606-A.

2.12 FINISHES

- A. Wood Finish: Cabinet surfaces shall be smoothly sanded, removing loose fiber, scratch marks and abrasions with all dust thoroughly removed with compressed air. Any metal parts shall be completely degreased.
1. Application: Finishes are to be applied in a dust-free area under ideal atmospheric conditions, and cured after application in a modern humidified oven at 140 degrees F. and 30% relative humidity.
 2. Case and Cabinets (Exteriors): Case and cabinet exposed exterior surfaces, including interiors of glazed cases and open shelving, shall be finished in an acid, alkali, solvent, water and abrasion-resistant finish. Surfaces shall be stainless with a non-fiber lifting stain, except where wiping stain or toner must be used to secure desired color. The color coat shall be thoroughly dried. A wash coat of Polyvinyl Butyral Resin shall then be applied, thoroughly dried, sanded and carefully dusted with tack rags. Mineral filler of proper color shall next be applied, carefully wiped across grain and thoroughly dried. Next a sealer coat shall be applied, thoroughly dried, sanded and carefully dusted with tack rags. Finally, a double pass coat of chemical resistant synthetic varnish shall be applied and thoroughly dried, providing a semi-gloss finish.
 3. Case and Cabinets (Interiors): Interior surfaces and unexposed exterior shall receive a double-pass coat of resinous wood sealer.
 4. Performance Tests: Chemical spot tests shall be made by applying 10 drops (approximately 1/2 cc) of each reagent to the surface at 77 degrees F. - three degrees and covered with an upright Fisher number 20892 wide mouth bottle, 2 oz. capacity, to regard evaporation. Spot tests of volatile solvents marked with an * shall be tested as follows: A one inch diameter ball of cotton shall be saturated with the solvent and placed on the surface to be tested and covered with an inverted Fisher number 20892 wide mouth bottle, 2 oz. capacity, to regard evaporation and keep the surface wet with solvent for duration of tests. All reagents shall remain on the surface for a period of one hour. At the end of the test, bottles are removed, excess solvents swabbed with cotton ball, and entire test surface rinsed thoroughly, dried carefully and examined. There shall be no effect other than slight discoloration, change of gloss, or temporary slight softening of the film.
 - a. Reagents Used:
 - 1) Hydrochloric Acid, 37%

- 2) Methyl Alcohol*
 - 3) Sulfuric Acid, 70%
 - 4) Ethyl Alcohol*
 - 5) Acid, 30%
 - 6) Ethyl Acetate*
 - 7) Acetic Acid, Glacial
 - 8) Acetone*
 - 9) Phosphoric Acid, 75%
 - 10) Methyl Ethyl Ketone*
 - 11) Ammonium Hydroxide, 28%
 - 12) Benzene*
 - 13) Sodium Hydroxide, 10%
 - 14) Toluene*
 - 15) Gasoline*
 - 16) Chloroform*
 - 17) Naptha*
 - 18) Carbon Tetrachloride*
5. Heat Resistant: Hot water (190 degrees - 205 degrees) shall be allowed to trickle onto the surface, which shall be set at an angle of 45 degrees from horizontal for a period of 5 minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water.
 6. Moisture Resistance: A cellulose sponge (2" x 3" x 1") shall be soaked with water and placed on the surface of the finish for a period of 100 hours. The sponge shall be maintained in a wet condition throughout duration of tests. At the end of the test, the surface shall be dried and upon examination, shall show no blushing or whitening of the finish.
 7. Impact Resistance: A one pound steel ball (approximately 2" in diameter) shall be dropped for a distance of one foot onto the finished surface of a 1/4" thick plywood panel supported underneath by solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close examination.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. Casework and Equipment shall conform to design and detail as indicated in this specification and on Drawings. Fabricate and assemble all casework at the mill as far as practicable.
- B. Where sections of cabinets are joined together, including sections of framing, they shall be secured with wood screws. Nailing will not be permitted.

3.2 FABRICATION OF CASEWORK AND SHELIVING

- A. Pre-Cut Openings: Fabricate casework with pre-cut openings wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating. Where openings are exposed, provide approved trim rings.

- B. Measurements: Before proceeding with fabrication of casework required to be fitted to other construction, obtain measurements and verify dimensions and Shop Drawing details as required for accurate fit.
- C. Casework shall arrive at the site complete with all finish hardware provided and installed including standards and brackets for shelves, hinges, butts, knobs, pulls, catches, latches, drawer slides, and all similar items to make casework fully operational.

3.3 INSTALLATION OF CASEWORK

- A. As far as possible casework shall be assembled, finished, and fitted out in the factory ready for final installation and connection on delivery to the site. Deliver and install all casework furnished under this Section.
- B. All installation work shall be performed by skilled mechanics in accordance with the best practices of the cabinetwork trade.
- C. Install all work plumb, level, true, and in plane with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including countertops); and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.
- D. All fastenings shall be concealed. All cabinetwork shall be erected plumb, true, level, and secure, blind-screwed where possible, or blind-nailed if approved, with all exposed screw heads plugged and nail heads set, and filled showing no hammer marks on finished surfaces.
- E. Where work is fitted to plasterboard or other materials, it shall be scribed tight without damaging other work. No shimming of bases to floor will be permitted. Bases shall be scribed to fit.
- F. Each piece shall be secured to adjacent cabinets and to existing floors, walls or partitions. Working surfaces and countertops shall be properly secured to base cabinets. Coordinate work with mechanical and electrical trades to ensure proper placement of services installed around piping. Coordinate construction paired installation of cabinets to provide clear space for piping beneath cabinets.
- G. Install casework without distortion so that doors and drawers will fit openings properly and be accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Between doors space shall not be larger than 1/8 inch. Complete the installation of hardware and accessory items as indicated. Maintain veneer sequence matching of casework with transparent finish.
- H. Countertops: Anchor securely to base cabinets and other support systems as indicated. Use angle braces and screws.

3.4 INSPECTION

- A. Installer must examine areas and conditions under which case work is to be installed, including condition of substrate to which casework cabinets are to be attached, and must notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

- B. This installer shall obtain and verify all measurements and conditions on the job, and shall assume all responsibility in respect to same.

3.5 CLEANING

- A. All debris and surplus materials resulting from installation work shall be removed promptly as work progresses by the installer, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.6 PROTECTION OF WORK

- A. Protect specified 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 under other contracts during installation until completion of specified work. After completion, the Contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect shall be repaired or replaced as determined by and to the satisfaction of the Architect.

3.7 SCHEDULES

- A. Reference the Schedules on the Fixed Casework Elevations, Details and Schedule Drawings for type/configuration, location and quantities of Casework Units, Appliances, Science Apparatus and Plumbing Fixtures schedules of items to be provided.

END OF SECTION

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. Recessed Foot Grilles: Deep-construction aluminum foot grilles.
 - 2. Recessed Entrance Mats: Deep-construction aluminum entrance mats with carpet inserts.
 - 3. Walk-Off Tiles (Recessed and Surface Mounted): Polypropylene rubber backed modular tiles.
 - 4. Substrate preparation for entrance mats and accessories.
- B. Related Work: The following items are not included in this Section and will be performed 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. 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.
- C. 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.
- D. 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 New Hampshire 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. Recessed Deep Construction Aluminum Foot grilles and Entrance Mats:
 - a. Bolar
 - b. Mats Incorporated.
 - c. Musson, R. C. Rubber Co. (The).
 - d. Tennessee Mat Company, Inc.
 - 2. Walk-Off Modular Tiles:
 - a. AFCO-USA.
 - b. Mats Incorporated.
 - c. Lees (Mohawk Industries).
 - d. Tennessee Mat Company, Inc.
 - e. US Mat & Rubber

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. Recessed Aluminum Foot Grilles for Exterior: Provide recessed foot grilles with non-slip aluminum treads and with the following properties:
 - 1. Sizes: As indicated on Drawings.
 - 2. Units shall be designed for installation flush with adjacent concrete pavement in recess as shown on Drawings.
 - 3. As far as possible, each foot grille shall be fabricated in one piece, or pieces as large as feasible for each installation.
 - 4. Tread Rails: T-shaped extruded aluminum rails, secured with bolted cross supports at 6 inches (152 mm) on center
 - a. Rail Material: 6063-T52 aluminum alloy extrusions, mill finish.
 - b. Rail Profile: 1 inch (25 mm) deep, with top flange 1/8 inch (3 mm) thick and 3/8 inch (9.5 mm) wide.
 - c. Spacing: Maximum 3/16 inch (4.8 mm) gap between top flanges.
 - 5. Treads: Linear.
 - 6. Basis of Design Product: Mats, Inc., Ultra Track, or equal by approved manufacturer.
- C. Recessed Aluminum Entrance Mats for Vestibules: Constructed from aluminum alloy type 6061-T6 fabricated as grilles to sizes indicated with mechanically fastened rails (swedge or key lock fastening of rails is unacceptable) and, where applicable, with finishes and profiles specified by the architect for use as entrance mat system as follows:
 - 1. T-shaped blades, 1-5/16 by 1/8 by 1-1/2 inch size with Polyimide Nylon fiber inserts; combined with Y-shaped blades, 11/16 by 1/8 by 1-1/2 inch size with an anti-slip polymer C9065 insertion of Durometer 90/65, 1/4 inch thick and locked in at each end. Spacing between blades not to exceed 3/16 inch.
 - 2. Perimeter Frames: Angle "L" frame or inverted "T", either "Level" or "Embedded" depending on the installation. Aluminum frames shall be pre-assembled at factory incorporating welded construction for all joints. Each grille section shall incorporate a non-visible section divider integrated and welded within the frame. Frames and grilles shall be shipped fully assembled in protective wooden crating to each jobsite. For sections larger than 6 by 8 feet a mechanical joint is to be provided.
 - 3. Basis of Design Product: Dual Track as manufactured by Mats Inc., or approved equal.
- D. Walk-Off Modular Tiles at interior lobbies and corridors as shown on plans:
 - 1. Construction -tufted.
 - 2. Surface Texture -textured patterned cut and loop.
 - 3. Gauge -1/12 (47.00 rows per 10 cm).
 - 4. Density -8,930.

5. Weight Density -321,488.
6. Stitches Per Inch -10.0 per inch (39.37/10 cm).
7. Finished Pile Thickness -.129" avg (3.3 mm).
8. Dye Method -yarn dyed.
9. Backing Material -ICT-RC - Fiberglass Reinforced Thermoplastic Composite Tile.
10. Face Yarn -Fortis Nylon 6,6 with Nylon 6,6 scraper yarn.
11. Fiber Technology -Sentry Soil Protection.
12. Face Weight -32.0 oz/yd² (1085.12 g/m²).
13. Size/Width -24" x 24" (60.9 cm x 60.9 cm).
14. Installation Method -brick ashlar, quarter turn.
15. IAQ Green Label Plus -1098.
16. CRI Rating -Severe Traffic.
17. Basis of Design Product For Recessed Application: Tuff-Stuff, Step In Style Modular as manufactured by Lees (Mohawk Industries).
18. Basis of Design Product For Surface Application: Diagonal Tile as manufactured by Mats Inc. with resilient reducer border on all four sides.

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.

2.8 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by entrance mat manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed entrance mat and is recommended by entrance mat manufacturer for releasable installation.
 - 1. VOC Limits: Provide adhesives with VOC content not more than 50g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

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 entrance mats and 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 riser mounted audience seating with folding seats and aisle lights.
- A. Related Work:
 - 1. Section 033000, Cast-In-Place Concrete; Substrate.
 - 2. Division 26, Electrical, for wiring to fixed seating.

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 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. Product Certificates: For each type of flame-retardant treatment of fabric, from manufacturer.
- E. Field quality-control reports.
- F. 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.

- G. 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.

1.7 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.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Arm Rests: Furnish 12 additional arm rests for Owner's attic stock.
 - 2. Fabric: Furnish 6 spare seats and seat backs for Owner's attic stock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. American Seating.
 - 2. Hussey Seating Company, U.S.A
 - 3. Irwin Seating Co.
- B. Basis of Design: Quattro as manufactured by Hussey Seating Company, U.S.A, or approved equal.
 - 1. Product: Hussey Quattro Chair System
 - a. Model: QUATTRO
 - b. Series: Classic
 - c. Back Foam: 2" [51mm]
 - d. Seat Type: Standard cushion.
 - e. Armrest Type: Wood veneer. Species as selected by Architect from manufacturers full range.
 - f. Standards: Cast aluminum
 - g. Chair Mount: Riser Mount
 - h. End Panels: None
 - 2. Product Description/Criteria:
 - a. Number of Chairs: As indicated on Drawings.
 - b. Number of Rows: As indicated on Drawings.
 - c. Number of Wheelchair Locations: As indicated on Drawings.
 - d. Number of ADA Easy Access End Standards: at all wheelchair locations.
 - e. Rise: As indicated.
 - f. Fabric: As selected by Architect from manufacturers full range.

2.2 MATERIALS

- 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: As selected by Architect from manufacturers full range.

- F. Concealed Plywood: Engineered Wood Association PS1-95 2000: Poplar
- G. Exposed Plywood: Hardwood Plywood ANSI/HPVA-1 2000: Match arm rests.
- H. Medium Density Fiberboard: ANSI A208-2-1986
- I. Plastic Laminate: NEMA LD3.1-1985, GP 48
- J. Polyurethane Foam Padding: ASTM D-3574
- K. Fabric: Provide 100% Marquesa Lana continuous filament Olefin as selected by Architect from manufacturer's full line. Up to 5 different colors may be selected.
- L. 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. Classic Series 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. RISER MOUNT STANDARDS Standards shall be riser 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. Color as selected by Architect from manufacturers full range.
2. Injection molded polypropylene or nylon: Shall be pigmented, in one of manufacturers standard colors as selected by Architect, and have a textured surface.
3. Fabric: As specified hereinabove.
4. Color: Seating Contractor shall submit color samples for owner's approval prior to manufacture.

F. Armrests:

1. Armrests, Solid wood: 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 Riser 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. Aisle Lights: Aisle lights shall operate from 24 volts (low voltage) requiring a transformer system (supplied by manufacturer). "Low Voltage Luminaire" electrical system approved by Underwriters Laboratories Inc. Aisle lights to be mounted onto aisle standard and will be furnished with cover as an integral part of the chair standard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine floors, risers, 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. 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. Review drawings for additional alignment requirements.

- C. Install riser-mounted attachments to maintain uniform chair heights above floor.
- D. Install chairs in curved rows at a smooth radius.
- E. Install seating so moving components operate smoothly and quietly.
- F. 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 126600
TELESCOPING STANDS

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 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, the following:
 - 1. Motorized, wall-attached telescoping bleachers.
- B. Related work includes but is not limited to the following work covered in other sections:
 - 1. Wood flooring at gymnasium: Section 096460 – Wood Athletic Flooring.
 - 2. Finish painting, except as specified herein: Section 099000 – Painting and Coating.
 - 3. Gymnasium equipment, except as specified herein; Section 116600 – Athletic Equipment.
 - 4. Rough-in and final connection of electrical work: Section 260000 – Electrical.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Engineer, fabricate and install telescopic seating systems to support the following loads without exceeding allowable design working stresses of materials involved, including anchors and connections.
- B. Seat Assembly: Bleachers shall support, in addition to their own weight, the following:
 - 1. Uniformly distributed live load: Not less than 100 pounds per square foot of gross horizontal projection.
 - 2. All seat and footboard members shall be designed for live loads of not less than 120 pounds per linear foot.
 - 3. Bleachers shall resist a horizontal sway force applied to the seats in a direction parallel to their length of 24 pounds per linear foot and a force of 10 pounds per linear foot perpendicular to length of seats.
- C. Railings, posts and sockets shall be designed to withstand 50 pounds per foot acting outward at top rail and 25 pounds per foot acting outward at mid-rail, applied separately.

- D. Units shall comply with all applicable codes.

1.4 SUBMITTALS

- A. Prepare and submit the following submittals in accordance with the requirements of Section 013300 – Submittals.
- B. Product Data: Submit manufacturer's product data demonstrating that products meet the requirements specified herein.
- C. Shop Drawings; Submit Shop Drawings of all telescoping bleacher work for Architect's approval before fabrication.
 - 1. Shop Drawings shall be at not less than 1/4" scale with details of fabricated items at 1/2" scale or larger.
 - 2. Show all dimensions, details of construction, details of installation, electrical connections, relation of adjoining work, reinforcement, welds, fastenings, anchorage and specifications of shop finishes.
 - 3. Take field measurements where required.
 - 4. Do no work without approved Shop Drawings.
- D. Furnish samples of all materials and finishes requested by Architect.
- E. Engineer Qualifications: Certification by a Professional Engineer registered in the project location that the equipment meets or exceeds the design criteria specified herein and all applicable Code requirements.

1.5 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.

1.6 OPERATING INSTRUCTIONS AND MAINTENANCE MANUAL

- A. Instruct to the Owner's satisfaction such persons as the Owner designates, in the proper operation and maintenance of the equipment and its parts.
- B. Furnish in accordance with requirements of Division 1, operating and maintenance manuals and forward same to the Architect for transmittal to the Owner.
- C. For maintenance purposes, provide Shop Drawings, Specifications and manufacturer's maintenance bulletins for each piece of equipment.
- D. Provide name, address and telephone number of the manufacturer's representative and service company for each piece of equipment, so that service and spare parts can be readily obtained.

1.7 GUARANTEE

- A. Attention is directed to provisions of the GENERAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide its standard guarantees for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturer 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. Hussey Seating Co.
 - 2. Interkal Inc.
 - 3. Universal Gym Equipment.
 - 4. Approved equal.
- B. Basis of Design: Products below are designated in terms of names of products manufactured by Hussey Seating, Inc., to establish the general character and materials required for telescoping seating for this project. Equivalent products by acceptable manufacturers will be approved.
 - 1. Product: MAXAM Telescopic Gym Seat System by Hussey Seating Company
 - a. Model: MAXAM26 Series Telescopic Gym Seats, adjustable row spacing in two inch increments from 22 inches [559] to 26 inches [660].

- b. Aisle Type: foot level aisles, front steps and intermediate aisle steps.
 - c. Seat Type: 10" Courtside plastic seat modules
 - 1) Seat color finish: As select ed by Architect from manufacturers standard colors
 - d. Rail Type: Self-storing end rail and store-in-place aisle hand rails.
 - 1) Rail color finish: Standard black.
 - e. Operation: electrical power.
 - 1) Electrical Power System: Integral power with pendant control.
- 2. Product Description/Criteria:
 - a. Bank Length: Refer to drawings.
 - b. Aisle Widths: Refer to drawings.
 - c. Number of Tiers: Refer to drawings.
 - d. Row Spacing(s): 24"
 - e. Row Rise: 9 5/8" rise
 - f. Open Dimension: Refer to drawings.
 - g. Closed Dimension: Refer to drawings.
 - h. Overall Unit Height: Refer to drawings.
 - i. Net Capacity: Refer to drawings.
- 3. Handicap Seating Provisions: Provide recoverable Flex Row handicapped locations to comply with ADA, as noted on drawings.
- 4. Special Seating Graphics: Provide contrasting or matching seats to create graphic pattern as indicated.

2.2 MATERIALS

- A. Lumber: ANSI/Voluntary Product 20, B & B Southern Pine
- B. Plywood: ANSI/Voluntary Product PS1, APA A-C Exterior Grade.
- C. Structural Steel Shapes, Plates and Bars: ASTM A 36.
- D. Uncoated Steel Strip (Non-Structural Components): ASTM A569, Commercial Quality, Hot-Rolled Strip.
- E. Uncoated Steel Strip (Structural Components): ASTM A570 Grade 33, 40, 45, or 50, Structural Quality, Hot-Rolled Strip.
- F. Uncoated Steel Strip (Structural Components): ASTM A607 Grade 45 or 50, High-Strength, Low Alloy, Hot-Rolled Strip.
- G. Galvanized Steel Strip: ASTM A653 Grade 40, zinc coated by the hot-dip process, structural quality.
- H. Structural Tubing: ASTM A500 Grade B, cold-formed.
- I. Polyethylene Plastic: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
- J. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.3 UNDERSTRUCTURE FABRICATION

A. Frame System:

1. Wheels: Not less than 5" [127] diameter by 1 1/4" [32] with non-marring soft rubber face to protect wood and synthetic floor surfaces, with molded-in sintered iron oil-impregnated bushings to fit 3/8" [10] diameter axles secured with E-type snap rings.
2. Lower Track: Continuous Positive Interglide System interlocks each adjacent CPI unit using an integral, continuous, anti-drift feature and through-bolted guide at front to prevent separation and misalignment. CPI units at end sections of powered banks and manual sections shall contain a Low Profile Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.
3. Slant Columns: High tensile steel, tubular shape.
4. Sway Bracing: High tensile steel members through-bolted to columns.
5. Deck Stabilizer: High tensile steel member through-bolted to nose and riser at three locations per section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller to prevent separation and misalignment. Incorporates multiple stops to allow field adjustment of row spacings.
6. Deck Support: Securely captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.

B. Deck System:

1. Section Lengths: Each bank shall contain sections not to exceed 25'-6" [7772] in length with a minimum of two supporting frames per row, each section.
2. Nose beam and Rear Riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40, Riser beam shall be continuously roll-formed of ASTM A653 grade 40. Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly.
3. Attachment: Through-Bolted fore/aft to deck stabilizers, and frame cantilevers.
4. Decking: 5/8" [16], AC grade, interior type with exterior glue, 5-ply, all plies Douglas Fir or Southern Pine with plugged crossbands, produced in accordance with National Bureau of Standards PS-1-97. Plywood shall be cut and installed with top, center and bottom ply grain-oriented from front of deck to rear of deck (nose beam to riser beam). Adjacent pieces shall be locked together with tongue and groove joint from front to rear of deck. Longest unsupported span: MAXAM 26, 21 1/2" [546]; MAXAM 33, 28 1/2" [724].
5. Deck End Overhang: Not to exceed frame support by more than 5'-7" [1702].

2.4 SEATING FABRICATION

A. Plastic Seat System:

1. Seat Modules: 18" [457] long assembled, injection-molded, high density polyethylene modules which provide scuff resistant textured 10" wide seat surface with 1/2" [13] minimum interlock on seat and face. Unit structural tested to 360 lbs occupant load.
2. Comfort Profile: Designed with anatomically contoured seat surface using multiple internal reinforcement ribs that allow form-fit deflection for maximum spectator comfort. Cantilevered to the rear to provide not less than 3" [76] smooth toe space beneath the seat.
3. Seat Support: Each plastic seat module shall be supported by internal steel structural members secured against fore/aft movement by 3/8" grade 5 steel fasteners creating a steel-to-steel connection, tying the seat structure firmly to the steel nose beam.
4. Number Plates: Seat module shall have recessed pockets to accept seat number plates.

5. End Caps: Each end of row shall be enclosed with matching end caps. End caps shall be designed flush with end-edge of seat top and provide indent for row letters. Color to match seat top.

2.5 SHOP FINISHES

- A. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with black "Dura-Coat" enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish.
- B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
 1. Steel nosing and rear risers shall be pre-galvanized with a minimum spangle of G-60 zinc plating.
 2. Decking shall have use-surfaces to receive both a sealer coat and wear-resistant high gloss clear urethane finish. Optional decking to have 0.030" laminated polyethylene wear surface.
 3. Injection Molded plastic seats to be selected from (15) fifteen standard colors. Colors shall be per manufacturer's standards
- C. Railings: Steel railings shall be finished with powder-coated semi - gloss black

2.6 FASTENINGS:

- A. Welds: Performed by welders certified by AWS standards for the process employed.
- B. Structural Connections: Secured by structural bolts with prevailing torque lock nuts, free-spinning nuts in combination with lock washers, or Riv-nuts in combination with lock washers.

2.7 ELECTRICAL OPERATION

- A. Integral Power: Furnish and install Hussey PF2, an integral automatic electro-mechanical powered frame propulsion system, to open and close telescopic seating. Integral Power and Control System shall be Underwriters Laboratories, Inc. (UL) approved and listed.
 1. Operation shall be with a removable pendant control unit which plugs into seating bank for operator management of stop, start, forward, and reverse control of the power operation.
 2. Each Powered Frame unit shall consist of output shaft gear reducer with 6" [152] diameter x 4" [102] wide wheels covered with non-marring 1/2" [13] thick composite rubber. Reducers shall be fitted with 3 phase induction motors which will provide an average operating speed of (46/25) f.p.m [.23/ .12 M/s].
 3. Operating Loads: Each Powered Frame provides (220 / 550) lbs pull force [978 / 2446 N] which equals approximately (28 / 35) psi [.192 / .241 N/mm2] lateral force on the floor..
 4. Electrical: Seating Manufacturer shall provide all wiring within seating bank including pendant control.
 - a. Each unit for PF2 is power operated by a 1/2 horsepower, 1725 R.P.M., 208 Volts, 50/60 Hz., three phase 1.25 service factor motor. This motor draws a full load current of 2.2 amperes. Power supply required shall be 120/208 volts three phase 5 wire plus

ground service with 20 amps. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electrical Code.

2.8 ACCESSORIES

- A. Front Aisle Steps: Provide at each vertical aisle location front aisle step. Front steps shall engage with front row to prevent accidental separation or movement. Steps shall be fitted with four non-skid rubber feet each 1/2" [13] in diameter. Blow molded end caps shall have full radius on all four edges. Quantity and location as indicated.
- B. Non-Slip Tread: Provide at front edge of each aisle location an adhesive-backed abrasive non-slip tread surface.
- C. Foot Level Aisles: Provide deck level full width vertical aisles located as indicated.
- D. Intermediate Aisle Handrails: Provide single pedestal mount handrails 34" [864] high with terminating mid rail. Handrails shall be attached to the socket and shall lift and rotate 90° for easy storage in socket. Aisle handrails that are detached from the socket for storage are unacceptable.
- E. Self Storing End Rails: Provide steel self-storing 42" [1066] high above seat, end rail with tubular supports and intermediate members designed with 4" [102] sphere passage requirements.
- F. Safety Accessories: Provide the following safety features:
 - 1. Coin Round or Roll all edges of exposed metal on top and underneath Bleacher to eliminate sharp edges. Provide safety ease edges, coined edges, or rounded edges for the bleacher understructure components as follows. Diagonal or X braces and deck support or deck stabilizers. Systems provided with sharp edges or corners, to be rounded off in the field and field painted.
 - 2. Provide plastic end cap on nose metal at Bank ends to close off edges to prevent spectator injury.
 - 3. Provide plastic end cap on back of deck supports on 1st 7 Rows to prevent spectator injury.
 - 4. On 1st Row, provide front and side skirt boards any where there is an exposed end to prevent players/balls from sliding underneath the 1st Row.
 - 5. Provide metal cover over motor chains and wheels to protect chains from debris and provide a safety switch that if cover is taken off the power system will not work.
 - 6. Provide metal end deck cover on each row to cover exposed edge of plywood at the ends of the bleachers.
 - 7. Powered frames systems without a metal protective housing, covering drive chain and drive wheels are not permitted under this specification
- G. Flex-Row: Provide first row modular recoverable seating units to be utilized by persons in wheel-chairs and able-bodied persons. Each Flex-Row unit shall have an unlock handle for easy deployment if wheelchair or team seating access is needed. Unlock handle shall lock the bleacher seats into position when fully opened.
 - 1. Provide a black full-surround steel skirting with no more than 3/4" floor clearance for safety and improved aesthetics.
 - 2. Provide a black injection molded end cap for the nose beam for safety and improved aesthetics.
 - 3. Provide a mechanical positive lock when the Flex-Row system is in the open and used posi-

- tion.
4. Flex-Row modular units are designed to achieve multi-use front row seating to accommodate team seating, ADA requirements and facility specific requirements. Flex-Row units are available in modular units from 2 to 7 seats wide as well as full section widths.
- H. End Closure Curtains: Provide closure curtains fabricated of vinyl-coated 14oz Polyester fabric on open ends of telescopic seating. Curtains to be permanently attached to wall or rear closure panel and secured to individual rows of seating. Curtain to open with seating unit into taught secure configuration and fold automatically as seating unit closes.
- I. Scorer's Table: Provide one 8' long x 15" wide scorer's table. Table top shall be tan high pressure laminate on 5/8" balance veneer core with edge molding. Integral perimeter frame to include tubular folding steel legs permanently attached to top with screws.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify area to receive telescoping gym seats are free of impediments interfering with installation and condition of installation substrates are acceptable to receive telescoping gym seats in accordance with telescoping gym seats manufacturer's recommendations. Do not commence installation until conditions are satisfactory.

3.2 INSTALLATION

- A. Manufacturer's Recommendations: Comply with telescoping gym seats manufacturer's recommendations for product installation requirements.
- B. General: Manufacturer's Certified Installers to install telescoping gym seats in accordance with manufacturer's installation instructions and final shop drawings. Provide accessories, anchors, fasteners, inserts and other items for installation of telescoping gym seats and for permanent attachment to adjoining construction.

3.3 ADJUSTMENT AND CLEANING

- A. Adjustment: After installation completion, test and adjust each telescoping gym seats assembly to operate in compliance with manufacturer's operations manual.
- B. Cleaning: Clean installed telescoping gym seats on both exposed and semi-exposed surfaces. Touch-up finishes to restore damage or soiled surfaces.

3.4 PROTECTION

- A. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure telescoping gym seats are without damage or deterioration at time of substantial completion.

END OF SECTION

SECTION 133420

MODULAR BUILDING 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 the following:
 - 1. Modular Buildings: New prefabricated modular buildings, consisting of the following:
 - a. Wood truss and timber framing.
 - b. Sheet metal siding and roofing.
 - c. Doors and frames.
 - d. Interior finishes.
 - e. Interior specialties.
 - f. Accessories.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design modular building systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of modular building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - 1. Wood framing system.
 - 2. Roof.
 - 3. Siding.
 - 4. Flashing and trim.
 - 5. Doors.
 - 6. Interior finishes.
 - 7. Accessories.
- B. Shop Drawings: For the following modular building system components. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt or Welded-Connection Plans: Submit anchor-bolt or welding plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts or welded connections required to attach modular building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate bolted connections, distinguishing between shop and field applications. Indicate welds, distinguishing between sizes and types. Include transverse cross-sections.
 - a. Show provisions for attaching parapets, roof curbs, service walkways, platforms, and pipe racks.
 3. Wall Panel Layout Drawings: Show layouts of exterior panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.
 4. Show roof-mounted items including equipment supports, pipe supports and penetrations, and items mounted on roof curbs.
 5. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
- C. Samples for Initial Selection: For units with factory-applied color finish.
- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:
1. Exterior and Interior Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
 3. Vapor-Retarder Facings: Nominal 6-inch-square Samples.
 4. Accessories: Nominal 12-inch-long Samples for each type of accessory.
 5. Interior Finishes: Nominal 12-inch-square Samples for each type of finish
- E. Delegated-Design Submittal: For modular building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified erector, manufacturer, and professional engineer.
- B. Welding certificates.
- C. Modular Building System Certificates: For each type of modular building system, from manufacturer.
1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - a. Name and location of Project.
 - b. Order number.

- c. Name of manufacturer.
 - d. Name of Contractor.
 - e. Building dimensions including width, length, height, and roof slope.
 - f. Governing building code and year of edition.
 - g. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - h. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - i. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - D. Erector Certificates: For each product, from manufacturer.
 - E. Manufacturer Certificates: For each product, from manufacturer.
 - F. Material Test Reports: For each of the following products:
 - 1. Wood framing including chemical and physical properties.
 - 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 - G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
 - H. Source quality-control reports.
 - I. Field quality-control reports.
 - J. Warranties: Sample of special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For modular panel finishes and door hardware to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Manufacturer Qualifications: A qualified manufacturer and member of the Modular Building Systems Association.
 - 1. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.
 - C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

- D. Source Limitations: Obtain modular building system components, including primary and secondary framing and panel assemblies, from single source from single manufacturer.
 - E. 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."
 - F. Wood Framing: Comply with ANSI/AF&PA NDS-2005, "National Design Specification for Wood Construction."
 - G. Fire-Resistance Ratings: Where indicated, provide panel assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
 - 2. Combustion Characteristics: ASTM E 136.
 - H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
 - 1. Review methods and procedures related to modular building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions.
 - 2. Review methods and procedures related to modular wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect modular wall panels.
 - d. Temporary protection requirements for modular wall panel assembly during and after installation.
 - e. Wall observation and repair after modular wall panel installation.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver manufactured items so as not to be damaged or deformed. Package for protection during transportation and handling.
 - B. Unload and install modular units directly onto foundation.

1.9 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when weather conditions permit modular panels to be installed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements:
 - 1. Established Dimensions for Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating modular panels without field measurements, or allow for field trimming modular panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts or welding connections into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 033000 - CAST-IN-PLACE CONCRETE.
- B. Coordinate installation of materials and products specified in other Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: 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. Lester Building Systems, LLC.
 - 2. Approved equal.

2.2 MODULAR BUILDING SYSTEMS

- A. Description: Provide a complete, integrated set of structurally-framed modular building system manufacturer's standard mutually dependent components and assemblies that form a building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.
 - 1. Provide modular building system of size and with bay spacings, roof slopes, and spans indicated.

2.3 MODULAR BUILDING SYSTEM PERFORMANCE

- A. Delegated Design: Design modular building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Modular building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
1. Design Loads: As indicated on Drawings and as required by the State Building Code.
 2. Deflection Limits: Design modular building system assemblies to withstand design loads with deflections no greater than the following:
 - a. Purlins and Rafters: Vertical deflection of 1/240 of the span.
 - b. Girts: Horizontal deflection of 1/240 of the span.
 - c. Roof Panels: Vertical deflection of 1/240 of the span.
 - d. Wall Panels: Horizontal deflection of 1/240 of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:
 - a. Lateral Drift for Earthquake: Maximum of 1/200 of the building height.
 - b. Lateral Drift for Wind: Maximum of 1/400 of the building height.
 4. Wall panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.
- C. Seismic Performance: Modular building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Air Infiltration for Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E 283 at static-air-pressure difference of 1.57 lbf/sq. ft.
- F. Water Penetration for Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft.
- G. Wind-Uplift Resistance: Provide roof assemblies that comply with UL 580 for Class 90.

2.4 ACCESSORIES

- A. General: Provide accessories as standard with modular building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
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.

2.5 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to evaluate product.
- B. Testing: Test and inspect shop connections for modular buildings according to the following:
 - 1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 - 2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.
- C. Product will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

2.6 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.
- B. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.
 - 1. Make shop connections by welding or by using high-strength bolts.
 - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - 4. Weld clips to frames for attaching secondary framing.
 - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- C. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- D. Wall Panels: Fabricate and finish wall panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and modular building system manufacturer's tolerances.
 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURE

- A. Erect modular building system according to manufacturer's written erection instructions and erection drawings.
- B. Do not field cut, drill, or alter structural members without written approval from modular building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.

2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.
1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.
 - a. Joint Type: Snug tightened or pretensioned.
- G. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.
- 3.4 FIELD QUALITY CONTROL
- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Inspection of fabricators.
 2. Wood frame construction.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Tests and Inspections:
1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E 165.
 - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E 164.
 - d. Radiographic Inspection: ASTM E 94.

- D. Product will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Doors: After completing installation, test and adjust doors to operate easily, free of warp, twist, or distortion.
- B. Door Hardware: Adjust and check each operating item of door hardware and each door to ensure proper operation and function of every unit. Replace units that cannot be adjusted to operate as intended.

3.6 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.
 - 1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - 2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Section 099000 - PAINTING AND COATING.
- D. Wall Panels: Replace wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. Doors and Frames: Immediately after installation, sand rusted or damaged areas of prime coat until smooth and apply touchup of compatible air-drying primer.
 - 1. Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 142400

HYDRAULIC ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.2 DESCRIPTION OF WORK

- A. The work of this section includes, but is not limited to, the following:
 - 1. Hydraulic passenger elevators.

1.3 RELATED WORK

- A. Examine Contract Documents for requirements that affect work of this Section. Other Specification Sections that relate directly to work of this Section include, but are not limited to:
 - 1. Section 055000, Metal Fabrications; pit ladder, sill angles.
 - 2. Division 26 - Electrical; power supply to machine room, telephone conduits.
 - 3. Section 096500 – Resilient Flooring; for rubber floor tile in elevator cab.
 - 4. Section 042000 – Unit Masonry; For masonry elevator shaft construction.
 - 5. Section 051200 – Structural Steel; For attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.

1.4 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. Shop Drawings: Provide large scale shop drawings for fabrication, installation, and erection of all parts of the work. Provide plans, elevations, and details of anchorages, connections and accessory items. Provide installation templates for work installed by others. Provide information on pit beam, overhead beam, buffer and rail reactions.
- C. Initial Selection Samples: Submit samples showing complete range of colors, textures, and finishes available for each material used.
- D. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Provide samples having minimum area of 144 square inches.
- E. Test Reports: Submit certified reports for tests required. Indicate test dates, test method, test results, interpretation of results and similar information. Submit additional copies directly to authorities having jurisdiction if required.

HYDRAULIC ELEVATORS

- F. Maintenance Manuals: Provide complete, detailed, 3 ring bound loose-leaf manuals listing operating and maintenance instructions, emergency instructions, parts listings and sources, recommended parts inventory, and similar information.
- G. Certificates and Permits: Provide copies of all inspection and acceptance certificates and permits required by authorities having jurisdiction to allow normal, unrestricted use of elevators.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage the elevator manufacturer or an experienced Installer approved by the elevator manufacturer who has completed elevator 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: In addition to local governing regulations, comply with the applicable provisions of the following:
 - 1. ASME A17.1, "Safety Code for Elevators and Escalators," referred to as the "Code."
 - a. Seismic Zone: Comply with code requirements for seismic risk zone 3 or greater.

1.6 TESTS

- A. Perform operational and acceptance tests required by authorities having jurisdiction. Do not permit any use of elevator until permitted by authorities having jurisdiction.
- B. Load elevator to its rated capacity and operate continuously over its entire travel distance, stopping at each level for a period of not less than 30 minutes. Record temperature rise of motors and pumps and report all failures in writing.
- C. Notify Architect and authorities having jurisdiction at least 36 hours in advance of tests to be performed.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations. Protect from damage and theft.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.8 SEQUENCING AND SCHEDULING

- A. Conference: Convene a pre-installation conference to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
- B. Electrical Work: Coordinate the location and requirements of power and telephone service to equipment rooms.
- C. Hoistway Entrances: Coordinate installation of hoistway entrances to ensure accurate alignment with elevator rails.
- D. Temporary Elevator Use: Do not permit temporary construction use of elevators, unless

specifically permitted in writing by Architect.

1.9 WARRANTY

- A. Provide written warranty signed by manufacturer, agreeing to repair or replace work which exhibits defects in materials or workmanship for a period of 12 months from date of Substantial Completion. "Defects" is defined to include, but is not limited to, operation and control system failures, performance below specified minimums, excessive wear, unusual noise or vibration, excessive maintenance need, and failure to perform as required.

1.10 MAINTENANCE CONTRACT

- A. Provide complete maintenance and service contract for period of 12 months from date of Substantial Completion. Contract shall cover everything except vandalism and abuse.
- B. Include in contract all consumable materials and supplies not covered by warranty.
- C. Include provision for 24 hour a day, seven day a week service with service response within two hours after first notification of need for service.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products of one of the following manufacturers if they meet or exceed the requirements of these specifications:
1. Delta Beckwith Elevator Co.
 2. Schindler Elevator.
 3. Thyssen Krupp.

2.2 ELEVATOR SCHEDULE

- A. Provide pre-engineered, packaged holeless hydraulic elevator units which fulfill the specification requirements, stretcher clearance requirements, and have specified features and characteristics as indicated on the Drawings and specified herein.

1. Elevators:

Quantity:	2
Capacity:	3,500 pounds passenger and 4,500 pounds freight
Speed:	125 fpm
Car Size:	Refer to Drawings.
Landings Served:	Refer to Drawings.
Entrance Size:	4'-0" by 7' -0".
Entrance Door Operation:	Refer to Drawings.
Power Supply:	480 volt, 3 phase, 60 Hz.

- B. Provide car enclosures which fulfill the specification requirements and have specified features and characteristics:

1. Walls: Vertical applied panel, stainless steel background with AISI No. 4 finish, plastic laminate and No. 4 stainless

- 2. Floors: steel on panel.
Resilient flooring provided by Section 096500 – Resilient Flooring.
- 3. Front and Transom: Full width wrap around, brushed stainless steel.
- 4. Doors: No. 4 stainless steel.
- 5. Ceiling: No. 4 stainless steel with downlight halogen lighting.
- 6. Sill: Extruded aluminum.
- 7. Handrails: Cylindrical, No. 4 stainless steel.
- 8. Accessories: Two speed fan, cab pads and hooks, telephone cabinet and hands-free phone.
- 9. Finishes: Signal and control equipment, Thyssen Krupp "Traditional Style", or approved equal.

2.3 CONTROLS AND FEATURES

A. Controls in Elevator Cabs: Provide the following:

- 1. Flush mounted metal panels containing illuminated plastic call buttons for each landing served.
- 2. Key controlled car light switch.
- 3. Key controlled car fan switch.
- 4. Alarm/emergency stop button.
- 5. Car position and direction indicators above door transom.
- 6. Audible floor and direction signals to comply with handicapped accessibility requirements.
- 7. All other switches and indicators required by authorities having jurisdiction.

B. Controls at Landings: Provide the following:

- 1. Recessed flush illuminated plastic call buttons with metal coverplate for travel directions possible.
- 2. Illuminated hall lanterns to signal direction of next car travel; these may travel with car.
- 3. Elevator position indicators to show location of each elevator; provide at main lobby only.

C. Miscellaneous Features: Provide the following:

- 1. Top of car inspection operation with light, power outlet and constant pressure controls.
- 2. Automatic leveling to within 3/8" under any load, at any speed, in either direction.
- 3. Fireman's emergency service switches acceptable to authorities having jurisdiction.
- 4. Hoistway access switches.
- 5. Key switches to lockout every floor individually.
- 6. Key switch to lockout all hall buttons.
- 7. Key switch operation from first floor for off hours.
- 8. Key controlled access at elevators with multiple side opening doors.
- 9. Door nudging feature to discourage holding elevator open.
- 10. Dual photo-eye door protection devices to stop and open doors when beam broken.
- 11. Minimum 30" x 30" ceiling hatch to permit carrying large construction materials such as carpet rolls.
- 12. Access control interface with proximity reader.
- 13. Battery lowering device.

D. Graphics: Provide visual and tactile graphics in strict compliance with requirements of

authorities having jurisdiction. Obtain Architect's approval of size, style, font, location and color; decals and applied labels are not permitted. Provide glazed cut-outs for flush, recessed installation of certificates and permits required by authorities having jurisdiction.

- E. Hoistway Entrances: Provide automatic, adjustable speed, flush metal panel doors. Provide minimum 16 gage doors and 14 gage frames. Sound deaden all work. Provide fully welded and mitered frames with welds ground flush and smooth so they are not visible after priming for painted work and uniformly finished to match adjacent metal on ornamental metal work.
 - 1. At all floors, provide No. 4 stainless steel doors and frames.
- F. Cab Entrances: Provide finished metal car entrances which match hoistway entrances in size, style, opening and other features. Open car doors and hoistway doors automatically and simultaneously.
- G. Cab Platform: Provide fully welded units with special sound deadening undercoating and sound isolated platen plate.
- H. Inserts: Provide inserts, brackets and anchors which are needed for installation of elevator components and accessories. Furnish inserts to other trades with detailed location templates, when installation of inserts is work of another section.

2.4 MACHINES AND EQUIPMENT

- A. Except as otherwise indicated or required, provide manufacturer's standard single-acting, under-car, hydraulic jack with electric pump and controller system in remote machine room. Provide machines and equipment that provide the performance level specified without overloading, overheating, and other problems.
- B. Piping: Provide size, type and weight as recommended by manufacturer for this Project application. Coat piping with asphaltic metal protective coating. Provide sound isolation couplings to prevent sound and vibration transmission from pump unit.
- C. Car Platform: Provide full welded units with special sound deadening undercoating and sound isolated platen plate.
- D. Inserts: Provide inserts, brackets and anchors required for installation of elevator components and accessories. Provide items to other trades with detailed location templates, when installation work is work of another Section.
- E. Motor Starters: Provide Wye Delta starters.

2.5 FABRICATION

- A. Fabricate work to be truly straight, plumb, level and square with uniformly finished surfaces. Provide work to sizes, shapes, and profiles indicated on approved shop drawings. Make work with uniform, tight joints.
- B. Do not display manufacturer's/fabricator's name on any visible location.
- C. Fabricate hydraulic cylinders with double containment sufficient to prevent oil leaks.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The Elevator Subcontractor shall examine substrates, supports, hoistways, hoistway openings, supporting structure, and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Installer accepts substrates, supports and other conditions.

3.2 INSTALLATION/ERECTION

- A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section.
- B. Install hydraulic jack casing with double containment, waterproof seals at pit floor. Install unit plumb and accurately located in hoistway; anchor securely.
- C. Install work plumb and accurately located in hoistway; anchor securely. Make welded connections wherever possible for connections which do not need future adjustment, replacement or routine maintenance.
- D. Coordinate with other work to avoid project delays and to ensure dimensional coordination of the work.
- E. Mount all equipment with sound and vibration isolating mounts to prevent transmission of noise to structure and cab.
- F. Accurately align hoistway entrances with elevator guide rails. Reduce clearances to minimum, safe, workable dimensions.
- G. Grout sills with non-staining, non-shrink grout. Set sills accurately aligned and slightly above finished floors.

3.3 ADJUSTING, CLEANING, PROTECTION

- A. Adjust operating parts to work easily, smoothly, and correctly.
- B. Touch-up damaged coatings and finishes to eliminate evidence of repair. Remove and replace work which cannot be satisfactorily repaired.
- C. Clean exposed surfaces using materials and methods recommended by manufacturer of material or product being cleaned. Remove and replace work that cannot be successfully cleaned.
- D. 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.

3.4 DEMONSTRATION

- A. Provide and review maintenance manual, demonstrate equipment, and instruct Owner's personnel in routine maintenance and proper operation procedures. Instruct Owner's

personnel in procedures to follow to check for sources of malfunctions and operational failures. Review procedures and responsibilities of continuing maintenance program.

END OF SECTION

SECTION 144200
WHEELCHAIR LIFTS

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. 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. Shop Drawings: For each lift. Include plans, elevations, sections, details, and attachments to other Work. Indicate loading on structure and required clearances.
- C. 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.
- D. 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.
- C. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA)".

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).
- 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, unless otherwise indicated.
 - 2. Rated Speed: 10 fpm.
 - 3. Rated Capacity: 750 pounds.
- C. Power Supply: Suitable for power available in building.
- D. Control System: Provide push button 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