

DSU Grossley Hall 2nd Floor Renovation
Contract: PC-2014-005-GHSFR

SECTION 01 11 00

SUMMARY OF THE WORK

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

Work to be accomplished in accord with this contract includes renovation of a portion of the second floor as noted including demolition and construction of new offices and classroom areas. Noted finishes, doors, hardware, lighting, mechanical systems, and other appurtenances indicated in the bidding documents. Also included is the replacement of 200 LF of fixed storefront window units located on both sides of the second floor. This phase of the project does not include the entire second floor.

1.2 RELATED DOCUMENTS

Drawings, specifications and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 specifications sections apply to this section.

1.3 CONTRACT

The specified work is to be accomplished under a single Base Bid, including selected Alternates.

1.4 WORK SCHEDULE/PHASING

The project will be constructed in phases as noted on the floor plan. Contractor shall provide partitions as needed to divide and protect the occupied area from the construction area. A work schedule shall be submitted to the owner and architect by the contractor prior to the pre-construction meeting. Areas of the second floor that are not part of this phase will be part of a future project and are not part of this current project.

1.5 USE OF PREMISES

Use of premises by Contractor to be limited to specified work areas and approved storage and staging areas. The remainder of the building will be occupied during construction. A portion of the second floor is noted as future work and is not a part of this project.

1.6 CODES

All work shall be performed in accordance with the applicable codes and rules and regulations of the regulatory agencies which have jurisdiction over this project and its location.

1.7 PROGRESS MEETINGS

In addition to a pre-construction meeting, progress meetings will be held bi-weekly during the course of the project at dates and times to be announced.

1.8 DELIVERED MATERIALS

Under no circumstances will Delaware State University sign as received any materials delivered to the job.

1.9 PERMITS AND LICENSES

All required permits will be paid for and obtained by the Contractor. In addition, all Contractors must be licensed by the State of Delaware and the City of Dover.

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Allowances.
- B. Types of Allowances may include the following (Refer to “Schedule of Allowances” include at the end of this Section):
 - 1. Lump-sum Allowances.
 - 2. Unit-cost Allowances.
- C. Selection and Purchase:
 - 1. Purchase products, systems and labor specifically selected (in writing) by the Owner and/or as indicated in the Schedule of Allowances.
- D. Submittals:
 - 1. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site and labor executed for use in fulfillment of each Allowance.
- E. Coordinate Allowance work with related work to ensure that each selection is completely integrated and interfaced with related work.
- F. Lump-Sum Allowances and Unit-Cost Allowances:
 - 1. These Allowances shall cover the cost to the Contractor, less any applicable trade discount, of the materials, labor and equipment required by the Allowance delivered at the site, and all applicable taxes.
 - 2. The Contractor's costs for unloading and handling on the site, labor, installation costs, overhead, profit and other expenses contemplated for the original Allowance shall be included separately in the Contract Sum and not in the Allowance.
 - 3. Whenever the cost is more than or less than the Allowance, the Contract Sum shall be adjusted accordingly by Change Order.
 - a. Change Order Mark-up: The amount of each change order resulting from final selection of products and systems covered by an Allowance shall be the difference

between the Contractor's purchase price amount and the Allowance, and shall not include Contractor's mark-up (or subcontractor's mark-up) except to the extent clearly demonstrated (by Contractor) that either scope of installation or nature of work required was changed from that which could have been foreseen from description of Allowance and other information in contract documents. No mark-up is permitted for selection of higher or lower priced materials or systems, of same scope and nature as originally indicated.

- b. Change Order Data: Where applicable, include in each change order proposal both the quantities of products being purchased and unit costs, along with total amount of purchase to be made. Where requested, furnish survey-of-requirements data to substantiate quantities. Indicate applicable taxes, delivery charges, and amounts of applicable trade discounts.

G. Unused Materials:

- 1. Return unused materials to the manufacturer or supplier for credit to the Owner, after installation has been completed and accepted.
 - a. When requested by the Owner, prepare unused material for storage by Owner where it is not economically practical to return the material for credit. When directed by the Owner, deliver unused material to the Owner's storage space. Otherwise, disposal of unused material is the Contractor's responsibility.

PART 2 - PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an Allowance promptly upon delivery for damage or defects.

3.2 PREPARATION

- A. Coordinate materials and their installation for each Allowance with related materials and installations to ensure that each Allowance item is completely integrated and interfaced with related work. The general contractor shall be responsible for any necessary work that is not covered in each vendor's proposal indicated in the Schedule of Allowances.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Provide an allowance of \$15,000 for unforeseen conditions.

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for Alternates.
- B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the bidding requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept the corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.
- C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project.
- D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.
- E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
 - 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 mentioned as part of the Alternate.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

Schedule of Alternates:

- A. Add Alternate No. 1:

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. To enable orderly review during progress of the work;
2. To provide for systematic discussion of problems;
3. Project meetings shall be held, in addition to the pre-construction meeting, twice during the construction period.

B. Related Work Described Elsewhere:

1. The Contractor's relations with his Vendors and material suppliers, and discussions relative thereto, are the Contractor's responsibility and are not part of project meetings content.

1.2 QUALITY ASSURANCE

- A.** Persons designated by the Contractor to attend and participate in the project meetings shall have all required authority to commit Contractor to solutions agreed upon in the project meetings.

1.3 SUBMITTALS

A. Agenda Items:

1. To the maximum extent practicable, advise the Architect at least 24 hours in advance of project meetings regarding all items to be added to the agenda.

B. Minutes:

1. The Architect will keep minutes of project meetings and will distribute copies to all parties present at meeting or listed on a permanent list of concerned parties.
2. The Contractor shall reproduce and distribute additional copies to other parties as needed to expedite the work.

PART 2 - PRODUCTS

2.1 MEETING SCHEDULE

- A.** Except as noted below for preconstruction meeting, progress meetings will be scheduled by the Architect.

- B. The Contractor shall schedule the presence of active and critical suppliers, and management personnel at these meetings.
- C. Representatives of the Contractor's suppliers shall be persons familiar with the details of the work. They shall be persons authorized to make commitments on matters of work progress, delivery dates, size of labor force, cost and other matters as necessary to expedite the work.

2.2 MEETING LOCATION

- A. To the maximum extent practicable, meetings will be held at the job site.

2.3 PRECONSTRUCTION MEETING

- A. This meeting will be scheduled by the Contractor within ten (10) days after the Owner has issued the notice to proceed order.
- B. Provide attendance by authorized representatives of the Contractor.
- C. Minimum agenda shall consist of distribution and discussion of the following data:
 - 1. Organizational arrangement of Contractor's forces and personnel, and those of materials suppliers and the Architect.
 - 2. Channels and procedures for communications.
 - 3. Construction schedule, including sequence of critical work.
 - 4. Contract Documents, including distribution of required copies of original Documents and revisions.
 - 5. Processing of Shop Drawings and other data submitted to the Architect for review.
 - 6. Processing of field decisions and Change Orders.
 - 7. Rules and regulations governing performance of the work.
 - 8. Procedures for security, quality control, housekeeping, and other related matters.

2.4 PROJECT MEETINGS

- A. To the maximum extent practicable, assign the same persons or persons to represent the Contractor at the project meetings throughout progress of the work. Materials suppliers, and others may be invited to attend those project meetings in which their aspects of work are involved.
- B. Minimum Agenda Shall Consist of the Following:
 - 1. Review, revise as necessary, and approve minutes of previous meetings.

2. Review progress of the work since last meeting, including status of submittals for approval.
 3. Identify problems which impede planned progress.
 4. Develop corrective measures and procedures to regain planned schedule.
 5. Complete other current business.
- C. Project meetings shall be held in addition to the preconstruction meeting, bi-weekly during construction. Two project meetings, as a minimum, shall be allotted for punchlist resolution.

END OF SECTION

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

1.1 GENERAL

A. Description

1. Work Included:
 - a. Submit to the Architect all shop drawings, product data and samples required by the specification sections.
2. Related Work Described Elsewhere:
 - a. Project Record Documents in Section 01 77 00.
3. Schedules:
 - a. Prepare and submit, with Construction Schedule, a separate schedule listing dates for submission and dates for review of shop drawings, product data and samples that will be needed for each product.
4. Definitions:
 - a. The definitions of the terms "Shop Drawings", "Product Data", and "Samples" shall be as defined by the General Conditions of the Contract for Construction.
5. The Phrase "By Others":
 - a. Where the phrase "By Others" (or a similar expression) appears on a submittal, and refers to any of the Contract Work, it shall be construed to mean "By the Contractor". The Architect's approval of any Submittal containing such phrase shall not be considered permission to delete any work from the Contract.
6. Time for Making Submissions:
 - a. The Contractor will be held responsible for any delay in the progress of the Work which may be due to his failure to make submittals as required herein.
7. Submittal Information:
 - a. Project title and number.
 - b. Consecutive number revised.
 - c. Data drawn and data revised.
 - d. Contractors certification that submittals have been checked by him for compliance with Contract Requirements.
 - e. Space for approval stamps.
 - f. Working dimensions and erection dimensions.
 - g. Arrangements.

- h. Sectional views.
- I. Details and methods of fabrications, assembly and erection.
- j. Details of connections with contiguous work.
- k. Fastenings.
- l. Equipment, accessories and trimmings.
- m. Kinds of materials.
- n. Protective coatings and factory finishes.
- o. Complete schedules.
- p. Other pertinent data.

1.2 SHOP DRAWINGS

A. Composite Shop Drawings and Field Installation Layouts:

1. The Contractor shall prepare composite shop drawings and field installation layouts, when required, to solve tight conditions. Such drawings shall consist of dimensioned plans and elevations and must give complete information particularly as to size and location of sleeves, inserts, attachments, openings, conduits, ducts, boxes, and structural interferences. The composite shop drawings and field installation layouts shall be coordinated in the field by the Contractor and involved subcontractors for proper relationship to the work of other trades, based on field conditions, and shall be checked and approved by them before submission to the Architect for his final review. The Contractor shall have competent technical personnel readily available for such coordination and checking, as well as for the supervision of the field installation of the work in accordance with the approved shop drawings field installation layouts.
2. Identify details by reference to sheet and detail numbers shown on Contract Drawings.
3. Minimum sheet size shall be 8-1/2" x 11".

B. See submission requirements for additional requirements.

1.3 PRODUCT DATA

A. Manufacturer's Standard Schematic Drawings:

1. Modify drawings to delete information which is not applicable to project.
2. Supplement standard information to provide additional information applicable to project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.

1. Clearly mark each copy to identify pertinent materials, products or models.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.
4. Show wiring diagrams and controls.

1.4 SAMPLES

- A. Submit in selected color and finish for final approval and comparison with products to be installed.
- B. Office Samples: Of sufficient size and quantity to clearly illustrate:
 - 1. Functional characteristics of product or material, with integrally related parts and attachment devices.
 - 2. Submit samples of extreme color or texture ranges.
- C. Color and Finish Selections Kits:
 - 1. Submit samples in book or kit form as necessary for selection of color or finish.
 - 2. Samples shall represent the full range of color and finish which are or will be available in the specified product at the time the project is built.
 - 3. Colors or finishes of unusually high cost, slow delivery, or available only on special order shall be submitted along with normal range items. Their special nature shall be noted.
- D. Submission of Samples:
 - 1. Except where otherwise specified, samples shall be submitted in duplicate accompanied by a letter of transmittal (signed by the Contractor in triplicate.) Any samples received without a cover letter will be considered "unclaimed goods" and held for a limited time only. The letter shall contain the following:
 - a. Contractor's name.
 - b. Project name and number.
 - c. List of samples being submitted.
 - d. Trade section to which samples refer.
 - e. Number of standard (ASTM, USASI, Commercial Standard, Federal Spec.) if any, with which samples complies.
 - f. Manufacturer's name or source of supply.
 - g. Trade name.
 - h. Catalog number.
 - i. Other pertinent information.
 - j. Any deviation from contract requirements.
 - k. Contractors certification that he has checked all samples for compliance with contract requirements and availability of material represented thereby.
 - 2. Each samples shall be labeled with the project name, project number, Contractor's name, trade name or other identification related to letter transmittal.
- E. Rejection of Work Not Conforming to Approved Samples:
 - 1. Samples submitted shall clearly show the full range of quality, color and texture which

will be evident in finished work. Materials which do not conform to approved samples shall not be used on this project and shall be discarded immediately upon their discovery. The approval or acceptance of samples will not preclude the rejection of any material not complying with contract requirements which is discovered prior to end of warranty period.

1.5 CONTRACTOR'S RESPONSIBILITIES

A. Contractor's Approval:

1. Before submitting shop drawings, product data, or samples for approval, the Contractor shall check them for accuracy, shall ascertain that all work contiguous with and having bearing on other work is accurate and that the work shown is in conformance with the Contract requirements. All submittals at the time of submission must bear the Contractor's stamp of approval as evidence that such submittals have been checked by the Contractor. Any submittals forwarded without such executed stamp of approval or whenever it is evident (despite the stamp) that the submittals have not been checked, they will be returned to the Contractor for resubmission without further consideration; In such event, it will be deemed that the Contractor shall bear the risk of all delays to the same extent as if no submittals at all have been forwarded.
2. Before submitting samples to Architect for approval, the Contractor shall assure himself that material represented thereby conforms to Contract requirements and is readily available in quantity required.

B. Improper Checking or Coordination:

1. The cost, if any, of change in the work necessitated by improper checking or improper coordination shall be paid for by the Contractor.

C. Claims for Extra Cost:

1. All claims for extra cost must be justified in writing by the subcontractor as hidden/unknown conditions discovered after the time of bid, such claim is to be made on the Contractor's letterhead of transmittal accompanying the submittal.

D. Delivery of Submissions to the Architect:

1. Submittals shall be sent to the Architect's office. Submittals shall be forwarded by the Contractor only, unless he has authorized another party to make submissions and has notified the Architect to this effect.

E. Contractor's Compliance:

1. The Contractor shall read and be familiar with all requirements of the Contract Documents concerning Shop Drawings, including the following:
 - a. The Contractor shall review and approve all shop drawings and stamp them accordingly, before forwarding them to the Architect.
 - b. By approving, stamping, and submitting shop drawings to the Architect, the

Contractor represents that he has verified:

all field dimensions
all field construction criteria
all materials and respective finishes
all catalog numbers, and coordinated each shop drawing with the requirements of the work and Contract Documents

- c. When submitting shop drawings, the Contractor shall notify the Architect, in writing of any deviations from the Contract Documents on the shop drawings.
- d. The Contractor understands that the Architect's review and approval of shop drawings does not relieve the Contractor of responsibility for:

Deviations from the Contract Document requirements, unless the Architect is informed, in writing of the deviations and approval is received, in writing, from the Architect for such deviation.

The Contractor understands that the Architect's review and approval of shop drawings does not indicate approval of changes in the Contract Time or cost.

The Contractor understands that no work shall be started on any item requiring shop drawings until proper approval of shop drawings is given by the Architect and that such work shall be in accordance with approved shop drawings.

Submission and processing of shop drawings will be in accordance with Contract Document requirements and the related responsibilities herein.

1.6 SUBMISSION REQUIREMENTS

A. Shop Drawings:

- 1. Shop drawings shall be submitted in the form of prints in a quantity sufficient for final distribution of reviewed submittals accompanied by a letter of Transmittal in triplicate, signed by the Contractor. Drawings shall be bound in complete sets and transmitted to the Architect.
- 2. Manufacturer's brochure, products, product data and other descriptive information which cannot be submitted in sepiia form shall be submitted as multiple copies. Submit in quantity sufficient for final distribution of approved submittals.

B. Submission for Mechanical and Electrical Work

- 1. In accordance with requirements specified for the mechanical and electrical work of the project, (plumbing, heating, ventilating, air-conditioning, electrical work,) the Contractor shall submit a complete list of material and other required information as specified under the respective Mechanical and Electrical Specification sections. No consideration will be given to partial lists submitted from time to time.

C. Manufacturer's Certificate

1. Where required by the specifications, submit manufacturer's affidavit certifying that material furnished for this project complies with Contract requirements.

D. Submittals Marked "Approved"

1. Submittals which require no corrections by the Architect will be marked "Approved".

E. Submittals Marked "Approved as Noted"

1. Submittals which require only a minor amount of correcting will be marked "Approved as Noted". This mark shall mean that checking is complete and all corrections are obvious without ambiguity. Fabrication will be allowed on work "Approved as Noted", provided such action will expedite construction and noted corrections are adhered to. If fabrication is not made strictly in accordance with corrections noted, the item shall be rejected in the field and the Contractor will be required to replace such work in accordance with corrected submittals, at his own expense.

F. Submittals Marked "Revise and Resubmit"

1. When submittals are marked "Revise and Resubmit", details of items noted by Architect shall be further clarified before approval can be given and noted items must not be fabricated until corrected and approved. Unmarked items may be fabricated unless otherwise directed.

G. Submittals Marked "Not Approved"

1. When submittals are contrary to contract requirements or too many corrections are required, they shall be marked "Not Approved". No work shall be fabricated under this mark. The Architect shall list his reasons for rejection on the submittals or in the transmittal letter accompanying their return. The submittals must be corrected and resubmitted for approval.

H. Return of Submittals to Contractor Unchecked

1. The Architect may return submittals to the Contractor for any of the following reasons, in which case the submission will not be considered official:
 - a. Submitted in violation of specified procedure.
 - b. Inadequately checked by Contractor.
 - c. Inaccurate and in substantial error.

1.7 RESUBMISSION REQUIREMENTS

A. Resubmission of Corrected Submittals

1. No changes shall be made by the Contractor to resubmitted shop drawings or product data in excess of those corrections noted by the Architect unless accompanied by a letter explaining the additional changes.

1.8 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

- A. After all corrections, changes and resubmittals have been made, the Contractor shall provide the following number of reviewed submittals, bearing his stamp of final approval, distributed as follows:

	Letter	Selection Sample	Record Sample	Shop Drawing	Report Certificate
Owner	1			2	1
Architect	1	1	1	1	1
Contractor	1			4	

1.9. ARCHITECT'S DUTIES

A. Architect's Approval

1. The Architect's approval will be only general in nature and shall not be construed as permitting any departure from Contract requirements, or as relieving the Contractor of responsibility for any errors, including details, dimensions or materials. If submittals show variations from Contract requirements the Architect may approve any or all such variations, subject to proper adjustment in the Contract. If the Contractor fails to describe such variation he shall not be relieved of the responsibility for executing the work in accordance with the Contract Documents, even though such submittals have been approved.

B. Approval of Products and Workmanship

1. Work of all trades (especially those which when finished will be permanently visible or must function faultlessly) will be subject to the following sequence of approval by the Architect.
 - a. Each trade shall submit one complete list of all materials proposed for use on the Project, which shall be approved by the Architect. The list shall include all necessary information to show compliance with requirements of the Specification.
 - b. Required product samples shall be submitted to the Architect for their approval.
 - c. Before work on any portion is started and if requested by the Architect, representative in-place samples of any specified work, shall be installed in the Architect's presence. In-place samples, when approved by the Architect shall become the standard for all similar work on the Project. The Contractor shall coordinate and schedule all in-place sample installations, which have been requested by the Architect so that:

All sample work shall be done on the same day, when one or more samples are requested of one or more trades.

Forty-eight (48) hours notice shall be given to the Architect before work starts.

C. Architect's Retention of Submittals for Future Checking

1. Where partial submissions cannot be checked until the complete submission has been received, or where correlation is required between material submitted and material not yet submitted, the Architect will advise the Contractor in writing that the submission will not be checked until all pertinent information is received and that the submission will not be considered official until it is complete in every aspect.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 TEMPORARY FACILITIES

- A. The Contractor shall furnish and maintain, during construction of the project, adequate facilities at the site for the use of himself as set forth below. Upon completion of the project, or as directed by the Architect, the Contractor shall remove all such temporary structures and facilities from the site, same to become his property and leave the premises in the condition required by the Contract.
- B. The Contractor and his subcontractors may maintain temporary facilities on the site in addition to those specified as may be necessary for the proper conduct of the work. These shall be located so as to cause no interference to any Contract work or occupied areas.
- C. Materials for temporary construction shall be hereinafter specified for various items, or when not so specified, shall be species and type suitable to the particular use and approved by the Architect. Salvaged materials which are in a safe and serviceable condition will generally be acceptable for such temporary construction. However, no split, splintered, deformed, ruptured, or similarly defective materials will be permitted. All materials for temporary construction shall be clean and dry. Materials which cannot be placed in a presentable condition will not be acceptable.
- D. All temporary facilities herein specified shall remain locked when not in use by contractors.

1.2 TEMPORARY OFFICE

The Contractor may, but not required to, maintain a temporary office for the project. The office may be equipped with a telephone listed in the Contractor's name, and other facilities as the Contractor may require. Provision of this temporary space must be coordinated with the Owner.

1.3 TEMPORARY WATER SERVICE

- A. Cold water may exist in the area of operations.
- B. The Owner will assume cost of water consumed if available, if responsible care and restraint is exercised by the Contractor in its use.

1.4 TEMPORARY ELECTRICAL SERVICE

- A. The Contractor shall make all necessary arrangements for temporary electricity for construction purposes, and furnish at his own expense, all temporary wiring, lamps, and accessories required for the completion of the work.
- B. The Owner shall provide the current; however, no improper, wasteful, or undue use of

electrical service will be permitted.

1.5 EXISTING UTILITIES

Prior to the closeout of the Project, the Contractor shall remove all temporary connections and return all sources to their original conditions prior to commencement of the work.

1.6 PARKING

A. Location of contractor parking shall be coordinated with the Owner.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations and procedures.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Document Instructions to Bidders: Product options and substitution procedures prior to bid date.
- B. Section 01 11 00 – Summary of the Work

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

1.04 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Notice to Proceed.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 - PRODUCTS

2.01 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.
- D. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products having any of the following characteristics:
 1. Made using or containing CFC's or HCFC's.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 1. Are extracted, harvested, and/or manufactured closer to the location of the project.
 2. Have longer documented life span under normal use.
 3. Result in less construction waste.
 4. Are made of vegetable materials that are rapidly renewable.
- D. Provide interchangeable components of the same manufacture for components being replaced.
- E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.

2.03 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 - EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- C. A request for substitution constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 - 2. Will provide the same warranty for the substitution as for the specified product.
 - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- D. Substitution Submittal Procedure:
 - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
 - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 3. The Delaware Engineering and Design Corporation will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. Prevent contact with material that may cause corrosion, discoloration, or staining.
- H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 66 00

STORAGE AND PROTECTION

PART 1 - GENERAL

- A. Sheds and Platforms: Waterproof shelter shall be provided for the storage of all materials subject to spoilage from water. Lumber shall be stored off the ground and kept dry. Platforms shall be provided for the storage of products likely to be stained if improperly stored.
- B. Storage Spaces: Limited space is available on the site for the storage of products, erection of offices, sheds, etc. Where possible the delivery of products shall be scheduled as to require a minimum of on-site storage.
- C. Transportation: All products shall be so crated, blocked and otherwise protected during transportation and handling to prevent staining, chipping, breakage, or any other physical damage. The Contractor shall provide any necessary lifting devices or machines, and the skilled personnel to operate such machines, necessary to handle products to prevent such damage.
- D. Store and protect all materials to be installed according to manufacturer's recommendations.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT

PART 1—GENERAL

1.1 SUMMARY

- A. Section includes: Administrative and procedural requirements for construction waste management activities.

1.2 DEFINITIONS

- A. Construction, Demolition, and Land clearing (CDL) Waste: Includes all non-hazardous solid wastes resulting from construction, remodeling, alterations, repair, demolition and land clearing. Includes material that is recycled, reused, salvaged or disposed as garbage.
- B. Salvage: Recovery of materials for on-site reuse, sale or donation to a third party.
- C. Reuse: Making use of a material without altering its form. Materials can be reused on-site or reused on other projects off-site. Examples include, but are not limited to the following:
 - 1. Crushing or grinding of concrete for use as sub-base material.
 - 2. Chipping of land clearing debris for use as mulch.
- D. Recycling: The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new product.
- E. Source-Separated CDL Recycling: The process of separating recyclable materials in separate containers as they are generated on the job-site. The separated materials are hauled directly to a recycling facility or transfer station.
- F. Co-mingled CDL Recycling: The process of collecting mixed recyclable materials in one container on-site. The container is taken to a material recovery facility where materials are separated for recycling.
- G. Approved Recycling Facility: Any of the following:
 - 1. A facility that can legally accept CDL waste materials for the purpose of processing the materials into an altered form for the manufacture of a new product.
 - 2. Material Recovery Facility: A general term used to describe a waste-sorting facility. Mechanical, hand-separation, or a combination of both procedures, are used to recover recyclable materials.

1.3 SUBMITTALS

- A. Contractor shall develop a Waste Management Plan: Submit 3 copies of plan within 14 days of date established for the Notice to Proceed.

- B. Contractor shall provide Waste Management Report: Concurrent with each Application for Payment, submit 3 copies of report.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Divert a minimum of 75% CDL waste, by weight, from the landfill by one, or a combination of the following activities:
 - 1. Salvage
 - 2. Reuse
 - 3. Source-Separated CDL Recycling
 - 4. Co-mingled CDL Recycling
- B. CDL waste materials that can be salvaged, reused or recycled include, but are not limited to, the following:
 - 1. Acoustical ceiling tiles
 - 2. Asphalt
 - 3. Asphalt shingles
 - 4. Cardboard packaging
 - 5. Carpet and carpet pad
 - 6. Concrete
 - 7. Drywall
 - 8. Fluorescent lights and ballasts
 - 9. Land clearing debris (vegetation, stumpage, dirt)
 - 10. Metals
 - 11. Paint (through hazardous waste outlets)
 - 12. Wood
 - 13. Plastic film (sheeting, shrink wrap, packaging)
 - 14. Window glass
 - 15. Wood
 - 16. Field office waste, including office paper, aluminum cans, glass, plastic, and office cardboard.

1.4 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED Accredited Professional, certified by the USGBC as waste management coordinator.
- B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- C. Regulatory Requirements: Conduct construction waste management activities in accordance with hauling and disposal regulations of all authorities having jurisdiction and all other applicable laws and ordinances.

- D. Preconstruction Conference: Schedule and conduct meeting at Project site prior to construction activities.
1. Attendees: Inform the following individuals, whose presence is required, of date and time of meeting.
 - a. Owner
 - b. Architect
 - c. Contractor's superintendent
 - d. Major subcontractors
 - e. Waste Management Coordinator
 - f. Other concerned parties
 2. Agenda Items: Review methods and procedures related to waste management including, but not limited to, the following:
 - a. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
 - b. Review requirements for documenting quantities of each type of waste and its disposition.
 - c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - e. Review waste management requirements for each trade.
 3. Minutes: Record discussion. Distribute meeting minutes to all participants.
Note: If there is a Project Architect, they will perform this role.

1.5 WASTE MANAGEMENT PLAN — Contactor shall develop and document the following:

- A. Develop a plan to meet the requirements listed in this section at a minimum. Plan shall consist of waste identification, waste reduction plan and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight throughout the plan.
- B. Indicate anticipated types and quantities of demolition, site-cleaning and construction waste generated by the project. List all assumptions made for the quantities estimates.
- C. List each type of waste and whether it will be salvaged, recycled, or disposed of in a landfill. The plan should include the following information:
 1. Types and estimated quantities, by weight, of CDL waste expected to be generated during demolition and construction.
 2. Proposed methods for CDL waste salvage, reuse, recycling and disposal during demolition including, but not limited to, one or more of the following:
 - a. Contracting with a deconstruction specialist to salvage materials generated,
 - b. Selective salvage as part of demolition contractor's work,
 - c. Reuse of materials on-site or sale or donation to a third party.

3. Proposed methods for salvage, reuse, recycling and disposal during construction including, but not limited to, one or more of the following:
 - a. Requiring subcontractors to take their CDL waste to a recycling facility;
 - b. Contracting with a recycling hauler to haul recyclable CDL waste to an approved recycling or material recovery facility;
 - c. Processing and reusing materials on-site;
 - d. Self-hauling to a recycling or material recovery facility.
 4. Name of recycling or material recovery facility receiving the CDL wastes.
 5. 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.
- 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. Including cost of collection containers for each type of waste.
 9. Net additional cost or net savings from waste management plan.

PART 2- PRODUCTS (Not Used)

PART 3— EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT, GENERAL

- A. Provide containers for CDL waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.
- B. The collection containers for recyclable CDL waste must contain no more than 10% non-recyclable material, by volume.
- C. Provide containers for CDL waste that is disposed in a landfill clearly labeled as such.
- D. Use detailed material estimates to reduce risk of unplanned and potentially wasteful cuts.

- E. To the greatest extent possible, include in material purchasing agreements a waste reduction provision requesting that materials and equipment be delivered in packaging made of recyclable material, that they reduce the amount of packaging, that packaging be taken back for reuse or recycling, and to take back all unused product. Insure that subcontractors require the same provisions in their purchase agreements.
- F. Conduct regular visual inspections of dumpsters and recycling bins to remove contaminants.

3.2 SOURCE SEPARATION

- A. General: Contractor shall separate recyclable materials from CDL waste to the maximum extent possible.

Separate recyclable materials by type.

1. Provide containers, clearly labeled, by type of separated materials or provide other storage method for managing recyclable materials until they are removed from Project site.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade and shape stockpiles to drain surface water and to minimize pest attraction. Cover to prevent windblown dust.
3. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from weather.

3.3 CO-MINGLED RECYCLING

- A. General: Do not put CDL waste that will be disposed in a landfill into a co-mingled CDL waste recycling container.

3.4 REMOVAL OF CONSTRUCTION WASTE MATERIALS

- A. Remove CDL waste materials from project site on a regular basis. Do not allow CDL waste to accumulate on-site.
- B. Transport CDL waste materials off Owner's property and legally dispose of them.
- C. Burning of CDL waste is not permitted.

END OF SECTION

SECTION 01 77 00

PROJECT RECORD DOCUMENTS AND CLOSEOUT

PART 1 - GENERAL

- 1.1 The Conditions of the Contract and Division 1 - General Requirements - apply to the work specified in this section.
- 1.2 PROJECT RECORD DOCUMENT PACKAGE
 - A. Maintenance of Documents
 1. Maintain one copy of Contract Drawings, Specifications, Addenda, review shop drawings, change orders, field records, surveys, and layout records.
 2. Store documents apart from documents used for construction. Maintain documents in clean, dry, legible condition. Do not use record documents for construction purposes.
 3. Make documents available at all times for inspection by Architect. Update all documents at least monthly.
 - B. Recording
 1. Stamp each document "PROJECT RECORD" 3/4 inch high letters.
 2. Do not permanently conceal any work until required information has been recorded.
 - C. Record Drawing: The Contractor shall keep a set of up-to-date marked prints of the "as-built conditions". The contract drawings shall be legibly marked to record actual construction such as:
 1. Horizontal and vertical location of underground utilities referenced to permanent surface improvements.
 2. Underground obstacles encountered and lines capped during construction.
 3. Location of internal utilities concealed in construction referenced to visible and accessible features of structure.
 4. Field alterations of dimensions and detail.
 5. Changes made by Change Order.
 6. Details not on original contract drawings.
 - D. Specifications and Addenda: Bind together.

- E. Approved Shop Drawings and Brochures: Maintain as record documents. Legibly note to record any changes made after review.
- F. Submitting: At completion of project, deliver record documents to Architect for transmittal to Owner as a package.
- G. Accompany submittal with transmittal letter, in duplicate, containing date, project, Contractor's name and address, title and number of each record document, and certification that each document as submitted is complete and accurate, signed by Contractor.

1.3 GUARANTEES, BONDS AND AFFIDAVITS

- A. Turn over guarantees, warranties, bonds and affidavits on various materials, neatly bound and in order, to the Architect for deliver to the Owner as part of the package.
- B. Affidavits verifying payments of all bills related to the project, release of liens (AIA G706A) for all subcontractors, bonding company approvals and consent of surety to final payment shall be required.
- C. Certification that all construction materials used and equipment supplied for this project are free of known hazardous materials such as PCBs and asbestos.

1.4 OPERATION AND MAINTENANCE DATA

- A. Turn over manuals and instructions, neatly bound and in order, to the Architect for delivery to the Owner.

1.5 EXTRA STOCK, SPARE PARTS, INSTRUCTION

- A. Turn over extra stock as specified in other sections of the specifications to the person designated by the Owner to be in charge of the operation and maintenance of the building.
- B. Provide instruction in operation and maintenance of equipment and finishes. Conduct meeting and individual training as needed to inform owner's operating personnel.
- C. Provide special tools for such items as louver vanes, adjustable dampers, thermostats, allen-head locking devices in triplicate.

END OF SECTION

SECTION 02 41 00

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 Definitions:

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated otherwise.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. 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.

1.2 Materials Ownership:

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be legally removed from Project site.

1.3 Submittals:

- A. Proposed protection measures. Contractors shall meet with Owners' Representative to determine protection measures for areas adjacent to construction.
- B. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition work, interruption of utility services, and locations of temporary partitions and means of egress, if required.
- C. Pre-demolition Photographs: Show existing conditions of adjoining construction.

1.4 Regulatory Requirements:

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

1.5 Standards:

- A. Comply with ANSI A10.6 and NFPA 241.

1.6 Project Conditions:

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

Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- C. Owner assumes no responsibility for condition of areas to be selectively demolished.
 - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Contractor shall meet with Owner's Representative to discuss power and utility shutdowns.

1.7 Hazardous Materials:

- A. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner.

1.8 Sale of removed items or materials on-site will not be permitted.

1.9 Existing Warranties:

- A. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 Repair Materials:

- A. Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

- 3.1 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- 3.2 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.
- 3.3 Existing Utilities:

- A. Maintain services indicated to remain and protect them against damage during selective demolition operations.

3.4 Utility Requirements:

- A. Locate, identify, disconnect, shut off, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - 1. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

3.5 Dangerous Materials:

- A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

3.6 Temporary Facilities:

- A. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent items to remain.

3.7 Temporary Enclosures:

- A. Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior if necessary.

3.8 Temporary Shoring:

- A. Provide and maintain shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.10 Dust Control:

- A. Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

3.11 Disposal:

- A. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent which complies with all state regulations.
2. Debris staging areas will be at agreed upon areas. Protection of property and people will be the responsibility of the contractor.

3.12 Cleaning:

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

3.13 Selective Demolition:

- A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.
 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

3.14 Existing Facilities:

- A. Comply with Owner's requirements for using and protecting building facilities during selective demolition operations.

3.15 Removed and Salvaged Items:

- A. Comply with the following:
 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. Protect items from damage during storage.

3.16 Removed and Reinstalled Items:

- A. Comply with the following:
 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.

3.17 Existing Items to Remain:

- A. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Owner, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.18 Patching and Repairs:

- A. Promptly repair damage to adjacent construction caused by selective demolition operations.
 1. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 2. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
 1. Floors and Walls: Where walls or partitions that are demolished 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 existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 4. Ceilings: patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.19 Disposal of Demolished Materials:

- A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior and interior nonload-bearing, cold form, steel-stud curtainwall.
 - 2. Cold form steel.

1.3 PERFORMANCE REQUIREMENTS

- A. AISI "Specifications": Calculate structural characteristics of cold-formed metal framing and connections according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members" and the following:
 - 1. Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections."
- B. Structural Performance: Engineer, fabricate, and erect cold-formed metal framing to withstand design loads within limits and under conditions required.
 - 1. Design Loads: As indicated.
 - 2. Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior and Exterior Nonload-Bearing Curtainwall: Lateral deflection of 1/360 of the wall height and 1/480 with brick veneer.
 - 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 (range) of 120 deg F (67 deg C).
- C. Design nonload-bearing curtainwall framing to accommodate lateral deflection without regard to contribution of sheathing materials.
- D. Engineering Responsibility: Engage a fabricator who assumes undivided responsibility for engineering cold-formed metal framing by employing a qualified professional engineer to prepare design calculations, shop drawings, and other structural data.

1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of cold-formed metal framing, accessory, and product specified.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel" and AWS D1.3 "Structural Welding Code--Sheet Steel."
 - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Fire-Test-Response Characteristics: Where fire-resistance-rated assemblies are indicated, provide cold-formed metal framing identical to that tested as part of an assembly for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Fire-Resistance Ratings: As indicated by design designations listed in UL "Fire Resistance Directory," or by Warnock Hersey or another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. Professional Engineer Qualifications: A professional engineer legally authorized to practice in the jurisdiction where Project is located and experienced in providing engineering services of the kind indicated that have resulted in the installation of cold-formed metal framing similar to this Project in material, design, and extent and that have a record of successful in-service performance.

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 in the Work include, but are not limited to, the following:

1. Angeles Metal Systems.
2. Clark-Cincinnati, Inc.
3. Consolidated Systems, Inc.
4. Dale//Incor Industries of Florida.
5. Dale Industries, Inc.
6. Design Shapes in Steel.
7. Dietrich Industries, Inc.
8. Incor Plant Dale Industries.
9. Knorr Steel Framing Systems.
10. MarinoWare; Div. of Ware Industries, Inc.
11. Super Stud Building Products, Inc.
12. Unimast, Inc.
13. United Construction Supply.
14. United States Steel.
15. Western Metal Lath Co.

2.2 WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs of web depths indicated, with lipped flanges, and complying with the following thicknesses prior to coating:
1. Design Uncoated-Steel Thickness: As required by structural performance, or as indicated.
 2. Flange Width: 1-5/8 inches (41 mm), minimum.
 3. Web: Punched.
- B. Steel Track: Manufacturer's standard U-shaped steel track, unpunched, of web depths indicated, with straight flanges, and complying with the following thicknesses prior to coating:
1. Design Uncoated-Steel Thickness: Matching steel studs.
 2. Flange Width: Manufacturers standard deep flange where required by design, standard flange elsewhere.

2.3 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa).
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Gusset plates.
 5. Deflection track and vertical slide clips.

6. Stud kickers and girts.
7. Joist hangers and end closures.
8. Reinforcement plates.

2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36 (ASTM A 36M).
- B. Cast-in-Place Anchor Bolts and Studs: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel hex-head bolts and studs; carbon-steel nuts; and flat, unhardened-steel washers. Zinc coated by the hot-dip process according to ASTM A 153.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times the design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Powder-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 the design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: Corrosion-resistant coated, self-drilling, self-threading steel drill screws.
 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. 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, with fluid consistency and a 30-minute working time.
- D. Thermal Insulation: ASTM C 665, Type I, unfaced mineral-fiber blankets produced by combining glass or slag fibers with thermosetting resins.

2.6 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, true to line, and with

connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.

1. Fabricate framing assemblies in jig templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to manufacturer's recommendations.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or distortion.
- C. Fabrication Tolerances: Fabricate assemblies to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements, including installation tolerances and other conditions affecting performance of cold-formed metal framing. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 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 and accessories plumb, square, true to line, and with connections securely fastened, according to manufacturer's recommendations and the requirements of this Section.
1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS requirements and procedures for welding, appearance

- and quality of welds, and methods used in correcting welding work.
- b. Locate mechanical fasteners and install according to cold-framed metal framing manufacturer's instructions with screw penetrating joined members by not less than 3 exposed screw threads.
- C. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
 - D. Provide temporary bracing and leave in place until framing is permanently stabilized.
 - E. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and double studs, inaccessible upon completion of framing work.
 - F. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.
 - G. Erection Tolerances: Install cold-formed metal framing to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings recommended by the manufacturer, but not greater than the following:
 - 1. Spacing: 24 inches (610 mm) for nail or power-driven anchors.
 - 2. Spacing: 32 inches (813 mm) for cast-in-place or expansion anchors.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Align studs vertically where wall-framing continuity is interrupted. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align trusses over joists. Where trusses cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

- G. Install headers over wall openings wider than the stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated or required by manufacturer.
 - 2. Install runner tracks and jack studs above and below wall openings. anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 - 1. Where type of supplementary support is not indicated, comply with stud manufacturer's recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced in rows not more than 48 inches (1219 mm) apart. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, clip angle fastened to webs of punched studs.
- J. Install steel-sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom track. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.4 NONLOAD-BEARING CURTAINWALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Squarely seat studs against webs of top and bottom tracks. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate steel framing from building structure at locations indicated to prevent transfer of vertical loads while providing lateral support.
 - 1. Install deflection track and anchor to building structure.

- E. Install horizontal bridging in curtainwall studs, spaced in rows not more than 48 inches (1219 mm) apart. Fasten at each stud intersection.
 - 1. Install additional row of horizontal bridging in curtainwall stud beneath deflection track when curtainwall studs are not fastened to an additional top track.
 - 2. Bridging: Cold-rolled steel channel, clip angle fastened to webs of punched studs.
 - 3. Install Steel Sheet: diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom track. Fasten clip angle connectors to multiple studs at ends of bracing and anchor to structure.
- 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 curtainwall-framing system.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanizing repair paint according to ASTM A 780 and the manufacturer's instructions.
- B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer to ensure that cold-formed metal framing is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wood framing.
 - 2. Miscellaneous lumber.
 - 3. Interior wood trim.
 - 4. Shelving and clothes rods.

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. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA C2 (lumber) and AWWA C9 (plywood), except that lumber that is not in contact with the ground and is continuously protected from liquid water may be treated according to AWWA C31 with inorganic boron (SBX).
- B. Kiln-dry material after treatment to a maximum moisture content of 19 percent.
- 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.

2.3 DIMENSION LUMBER

- A. General: Of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.

- B. Non-Load-Bearing Interior Partitions: Construction, Stud, or No. 2 grade and any of the following species:
 - 1. Mixed southern pine; SPIB.
 - 2. Eastern softwoods; NELMA.
 - 3. Northern species; NLGA.
 - 4. Western woods; WCLIB or WWPA.

- C. Other Framing: Construction or No. 2 grade and any of the following species:
 - 1. Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; NLGA, WCLIB, or WWPA.
 - 2. Hem-fir or Hem-fir (north); NLGA, WCLIB, or WWPA.
 - 3. Southern pine; SPIB.
 - 4. Spruce-pine-fir (south) or Spruce-pine-fir; NELMA, NLGA, WCLIB, or WWPA.

2.4 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Cants.
 - 3. Nailers.
 - 4. Furring.
 - 5. Grounds.

- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content of any species.

- C. For exposed boards, provide lumber, with 19 percent maximum moisture content, of eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Finish or 1 Common (Colonial) grade; NELMA, NLGA, WCLIB, or WWPA.

- D. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine, No. 2 grade; SPIB.
 - 2. Eastern softwoods, No. 2 Common grade; NELMA.
 - 3. Northern species, No. 2 Common grade; NLGA.
 - 4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 INTERIOR WOOD TRIM

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish): Clear, kiln-dried, red oak or white maple finished lumber (S4S), selected for compatible grain and color.

- B. Lumber Trim for Opaque Finish (Painted): Finished lumber (S4S), either finger-jointed or solid lumber, of one of the following species and grades:
 - 1. Grade D Select Finish or 2 Common eastern white pine; NELMA or NLGA.
 - 2. Grade D Select (Quality) Idaho white, lodgepole, ponderosa, or sugar pine; NLGA or WWPA.
- C. Moldings: Made to patterns included in WMMPA WM 7. Wood moldings made from kiln-dried stock and graded according to WMMPA WM 4.
 - 1. Moldings for Opaque Finish (Painted): P-grade eastern white, Idaho white, lodgepole, ponderosa, or sugar pine

2.6 SHELVING AND CLOTHES RODS

- A. Shelving: 3/4-inch 19-mm boards of same species and grade indicated above for exposed boards.
- B. Clothes Rods: 1-1/2-inch- (38-mm-) diameter, aluminum tubes.

2.7 FASTENERS

- A. General: 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. Power-Driven Fasteners: CABO NER-272.
- C. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. 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.
- B. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
- C. Countersink fastener heads on exposed carpentry work and fill holes with wood filler.
- D. Wood Structural Panels: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

- E. Wood Trim Installation: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.
1. Match color and grain pattern across joints.
 2. Install trim after gypsum board joint-finishing operations are completed.
 3. Install to tolerance of 1/8 inch in 96 inches3 mm in 2438 mm for level and plumb. Install adjoining finish carpentry with 1/32-inch0.8-mm maximum offset for flush installation and 1/16-inch1.6-mm maximum offset for reveal installation.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
1. Interior standing and running trim.
 2. Miscellaneous exterior trim.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 6 Section "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 2. Division 9 Section "Interior Painting" for priming and back priming of finish carpentry.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of factory-fabricated product and process specified, including details of construction relative to materials, dimensions of individual components, profiles, textures, and colors.
- C. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated material:
1. For each type of preservative-treated wood product include certification by treating plant stating type of preservative solution and process used, net amount of preservative retained, and compliance with applicable standards.
 2. For water-borne-treated products include statement that moisture content of treated materials was reduced to levels indicated before shipment to Project site.
 3. For fire-retardant-treated wood products include certification by treating plant that treated materials comply with specified standard and other requirements.

1.4 QUALITY ASSURANCE

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

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.
- B. Do not deliver interior finish carpentry until environmental conditions meet requirements specified for installation areas. If finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels through the remainder of construction period.
- B. Weather Limitations: Proceed with installing exterior finish carpentry only when existing and forecasted weather conditions will permit work to be performed according to manufacturer's recommendations and warranty requirements and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work may include only those with proven experience in providing such products.

2.2 MATERIALS, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
 - 1. NELMA - Northeastern Lumber Manufacturers Association.
 - 2. NHLA - National Hardwood Lumber Association.
 - 3. NLGA - National Lumber Grades Authority.

4. RIS - Redwood Inspection Service.
 5. SCMA - Southern Cypress Manufacturers Association.
 6. SPIB - Southern Pine Inspection Bureau.
 7. WCLIB - West Coast Lumber Inspection Bureau.
 8. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
1. For exposed lumber, furnish pieces with grade stamps applied to ends or back of each piece, or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.
- D. Softwood Plywood: Comply with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood."
- E. Hardwood Plywood: Comply with HPVA HP-1, "Interim Voluntary Standard for Hardwood and Decorative Plywood."
- F. Hardboard: ANSI/AHA A135.4
- G. Medium-Density Fiberboard: ANSI A208.2, Product Class MD.
- H. Medium-Density Fiberboard: Product made without formaldehyde and complying with ANSI A208.2, Product Class MD.
1. Product: Subject to compliance with requirements, provide "Medite II" by Medite Corp.
- I. Particleboard: ANSI A208.1, Grade M-2.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Nonpressure Process: Comply with NWWDA I.S. 4 and the following for items indicated to receive water-repellent preservative treatment.
1. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient.
 2. Water-Repellent Preservative/Insecticide: NWWDA-tested and -accepted preservative and water-repellent formulation containing 3-iodo-2-propynyl butyl carbamate (IPBC) as its active ingredient, combined with an insecticide containing chloropyrifos as its active ingredient.
- B. Preservative Treatment by Pressure Process: Comply with AWPA C2 (lumber) and AWPA C9 (plywood) and the following for items indicated to receive pressure preservative treatment. Mark each treated item with the Quality Mark Requirements of an inspection agency approved by American Lumber Standards Committee Board of Review.

1. Preservative Chemicals: Pressure-impregnate woodwork with preservative chemicals acceptable to authorities having jurisdiction. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.
 - a. Do not use chemicals containing chromium or arsenic.
2. Pressure-treat aboveground items with preservatives to a minimum retention of 0.25 lb/cu. ft. (4 kg/cu. m). Kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively.

2.4 INTERIOR STANDING AND RUNNING TRIM

- A. Softwood Trim: Provide finished lumber and moldings complying with the following requirements including those of the grading agency listed with species:
 1. Species: Eastern white pine; NELMA or Idaho white, lodgepole, ponderosa, or sugar pine; WWPA.
 2. Grade: Prime Finish.
 3. Texture: Surfaced (smooth).
 4. Lumber for Painted Finish: Glued-up lumber or solid lumber stock.
- B. Hardwood Trim: Provide finished hardwood lumber and moldings complying with the following requirements:
 1. Species and Cut: Rift-sawn, clear, kiln-dried red oak selected for compatible grain and color.
 2. Texture: Surfaced (smooth).
 3. Lumber for Transparent Finish (Stained or Clear): Solid lumber stock.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails of the following materials, in sufficient length to penetrate minimum of 1-1/2 inches (38 mm) into substrate, unless otherwise recommended by manufacturer.
 1. Stainless steel.
- B. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
 1. Where finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153.
- C. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry use.

2.6 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry on relative humidity conditions existing during time of fabrication and in installation areas.
- B. Fabricate finish carpentry to dimensions, profiles, and details indicated.
 - 1. Back out or kerf backs of the following members, except members with ends exposed in finished work:
 - a. Interior standing and running trim, except shoe mold and crown mold.
 - 2. Ease edges of lumber less than 1 inch (25 mm) in nominal thickness to 1/16-inch (1.5-mm) radius.
 - 3. Ease edges of lumber 1 inch (25 mm) or more in nominal thickness to 1/8-inch (3-mm) radius.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Condition finish carpentry to average prevailing humidity conditions in installation areas before installation, for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.
- C. Prime and backprime lumber for painted finish exposed on the exterior. Comply with requirements for surface preparation and application in Division 9 Section "Interior Painting."

3.3 INSTALLATION, GENERAL

- A. Do not use finish carpentry materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
 - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install finish carpentry plumb, level, true, and aligned with adjacent materials. Use concealed shims where required for alignment.

1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 2. Countersink nails, fill surface flush, and sand where face nailing is unavoidable.
 3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) for plumb and level. Install adjoining finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.
 4. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim and rails. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.
- C. Finish according to specified requirements.
- D. Refer to Division 9 Sections for final finishing of finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches (610 mm) long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, if required.
1. Match color and grain pattern across joints.
 2. Install trim after gypsum board joint finishing operations are completed.
 3. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 ADJUSTING

- A. Repair damaged or defective finish carpentry where possible to eliminate functional or visual defects. Where not possible to repair, replace finish carpentry. Adjust joinery for uniform appearance.

3.6 CLEANING

- A. Clean finish carpentry on exposed and semiexposed surfaces. Touch-up factory-applied finishes to restore damaged or soiled areas.

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure finish carpentry is without damage or deterioration at the time of Substantial Completion.

END OF SECTION

SECTION 07 21 00

BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Concealed building insulation.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics and other methods indicated with product, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

PART 2 - PRODUCTS

2.1 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
- B. Mineral-fiber blanket insulation consisting of fibers manufactured from glass:
 - 1. Faced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III, Class A; Category 1, faced with foil-scrim-kraft, foil-scrim, or foil-scrim-polyethylene vapor-retarder membrane on one face.

2.2 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.3 INSULATION FASTENERS

- A. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain indicated air space between face of insulation and substrate to which anchor is attached.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install insulation to comply with insulation manufacturer's written instructions applicable to products and application indicated. 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.
- B. Installation of General Building Insulation: Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
 - 1. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant.
 - 2. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
 - a. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
 - 3. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - a. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm) support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.
 - 5. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - a. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - b. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
 - c. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with

insulation-retaining washers, taking care not to compress insulation below indicated thickness.

d. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed wall sheet metal fabrications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Distinguish between shop- and field-assembled work.
 - 3. Include identification of finish for each item.
 - 4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.
- B. Product test reports.
- C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 1. Finish Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Sheet Metal Standard for Copper: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.
 1. As-Milled Finish: [Mill] [One-side bright mill] [Standard one-side bright] [Standard two-side bright].
 2. Alclad Finish: Metallurgically bonded surfacing alloy on both sides, forming aluminum sheet with reflective luster.
 3. Factory Prime Coating: Where painting after installation is required, pretreat metal with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil (0.005 mm).

4. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 5. Color Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
 - a. Color: Selected by Owner.
 6. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 7. Color: Selected by Owner.
- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with no 2D finish.
- D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 (Z275) coating designation or aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation, Grade 40 (Grade 275); prepainted by coil-coating process to comply with ASTM A 755/A 755M.
1. Surface: Mill phosphatized for field painting.
 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. Three-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
 3. Color: As selected by Owner.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
 - 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. Atlas Roofing Corporation; Summit.
 - b. Engineered Coated Products; Nova-Seal II.
 - c. Kirsch Building Products, LLC; [Sharkskin Comp] [Sharkskin Ultra].
 - d. SDP Advanced Polymer Products Inc; Palisade.
- C. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
 - b. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - e. Metal-Fab Manufacturing, LLC; MetShield.
 - f. Owens Corning; WeatherLock Specialty Tile & Metal Underlayment.
 - g. Polyguard Products, Inc.; Deck Guard HT.
 - h. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
 - i. SDP Advanced Polymer Products Inc; Palisade SA-HT.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
- D. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal [or manufactured item] unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal[or manufactured item].
1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Copper Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
 3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 5. Fasteners for [Zinc-Coated (Galvanized)] [Aluminum-Zinc Alloy-Coated] Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
1. For Copper: ASTM B 32, with maximum lead content of 0.2 percent.
 2. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
 3. For Zinc-Coated (Galvanized) Steel: ASTM B 32 with maximum lead content of 0.2 percent.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane, silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 MANUFACTURED REGLETS

- A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cheney Flashing Company.
 - b. Fry Reglet Corporation.
 - c. Heckmann Building Products, Inc.
 - d. Hickman, W. P. Company.
 - e. Hohmann & Barnard, Inc.
 - f. Keystone Flashing Company, Inc.
 - g. National Sheet Metal Systems, Inc.
 - h. Sandell Manufacturing.
 2. Material: Aluminum, 0.024 inch (0.61 mm) thick.
 3. Finish: With manufacturer's standard color coating.

2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. Obtain field measurements for accurate fit before shop fabrication.
 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- E. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

- F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.
- H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 12-foot- (3.6-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, fasten and seal watertight.
 - 1. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch (1.27 mm) thick.
- B. Base Flashing: Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch (1.02 mm) thick.
- C. Counterflashing and Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch (0.81 mm) thick...
- D. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches (50 mm).
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side

edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches (38 mm); however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum sheet.
 2. Do not use torches for soldering.
 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
 5. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints minimum of 4 inches (100 mm).
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Reglets: Installation of reglets is specified in Section 042000 "Unit Masonry."
- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.5 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

SECTION 07 92 00

SEALANTS AND CAULKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
 - 1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces.
 - 2. Exterior joints in horizontal traffic surfaces.
 - 3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 4. Interior joints in horizontal traffic surfaces.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: 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 exposed surfaces adjacent to joint sealants.
- D. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
- E. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.
- F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
 - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Installer's Warranty: Written warranty, signed by Installer agreeing 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.
- 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 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Match Architect's samples.
- C. Colors of Exposed Joint Sealants: As indicated by referencing manufacturer's designations.
- D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- B. Additional Movement Capability: Where additional movement capability is required, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719.
- C. Stain-Test-Response Characteristics: Where elastomeric sealants are applied to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant Standard: Comply with ASTM C 834.

2.5 PREFORMED JOINT SEALANTS

- A. Preformed Silicone-Sealant System: For each product of this description, provide manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit required joint widths, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin, or
 - 2. Type O: Open-cell material, or,
 - 3. Type B: Bicellular material with a surface skin.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 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 with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
 - 5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

- G. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
 2. Apply a bead of silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's printed schedule and covering a bonded area of not less than a 3/8 inch (10 mm). Hold edge of sealant bead inside of masking tape by 1/4 inch (6 mm).
 3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
 4. Complete installation of horizontal joints before installing vertical joints. Lap vertical joints over horizontal joints. At end of joints, cut silicone extrusion with a razor knife.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion.

If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel doors.
 - 2. Steel door frames.
 - 3. Fire-rated door and frame assemblies.
- B. Related Sections include the following:
 - 1. Division 8 Section "Flush Wood Doors" for wood doors installed in steel frames.
 - 2. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.3 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Details of doors including vertical and horizontal edge details.
 - 3. Frame details for each frame type including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for factory-finished doors and frames.

- D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door 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, based on testing according to NFPA 252.
 - 1. Test Pressure: Test at atmospheric pressure.
 - 2. 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 standard construction requirements for tested and labeled fire-rated door assemblies except for size.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch-(100-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Benchmark Commercial Doors; a division of General Products Co., Inc.
 - c. Ceco Door Products; a United Dominion Company.
 - d. Curries Company.
 - e. Steelcraft; a division of Ingersoll-Rand.
 - f. S.W. Fleming, LTD.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with an A40 (ZF120) zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized; suitable for unexposed applications; stretcher-leveled standard of flatness where used for face sheets.

2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
- C. Exterior Doors: 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 1 (Full Flush).
- D. Vision Lite Systems: Manufacturer's standard kits consisting of glass lite moldings to accommodate glass thickness and size of vision lite indicated.

2.4 FRAMES

- A. General: Provide steel frames for doors and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.053-inch- (1.3-mm-) thick steel sheet.
- C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- D. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction.
- C. Interior Door Faces: Fabricate exposed faces of doors and panels from cold-rolled steel sheet.
- D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch (3.2 mm) at jambs and heads, except not more than 1/4 inch (6.4 mm) between pairs of doors. Not more than 3/4 inch (19 mm) at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Single-Acting, Door-Edge Profile: Square edge.
- H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- K. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
 - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.
- L. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
 - 1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.
- M. Frame Construction: Fabricate frames to shape shown.

1. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 2. For interior applications, fabricate knock-down frames with mitered or coped corners, for field assembly.
 3. Provide welded frames with temporary spreader bars.
- N. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- O. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.
- P. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
1. Provide nonremovable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.
 2. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.
- Q. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.6 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
- B. Door Color to Match: Sherwin Williams, SW7068, Grizzle Gray.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
 1. In existing concrete construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
 2. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 3. For in-place gypsum board partitions, install knock-down, drywall slip-on frames.
 4. Install fire-rated frames according to NFPA 80.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

1. Fire-Rated Doors: Install within clearances specified in NFPA 80.
2. Smoke-Control Doors: Install to comply with NFPA 105.

3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION

SECTION 08 14 00

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes solid core doors as follows for swing and pocket doors:

1. Doors with wood-veneer faces and factory finishing.

1.2 SUBMITTALS

A. Product Data: For each type of door. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details; location and extent of hardware blocking; mortises, holes, and cutouts; requirements for veneer matching; factory finishing; fire ratings; and other pertinent data.

C. Samples: For each face material and finish.

1.3 QUALITY ASSURANCE

A. Quality Standard: Comply with NWWDA I.S.1-A, "Architectural Wood Flush Doors."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. GRAHAM Manufacturing Corp.
2. Mohawk Flush Doors, Inc.
3. Weyerhaeuser Company.

2.2 DOOR CONSTRUCTION

A. Doors for factory-applied transparent finish:

1. Grade: Premium, with Grade AA faces.
2. Species and Cut: White birch, rotary cut.
3. Match between Veneer Leaves: Book match.
4. Assembly of Veneer Leaves on Door Faces: Center balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

2.3 FABRICATION

- A. Fabricate doors in sizes indicated for Project-site fitting.
- B. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting.
- C. Factory machine doors for hardware that is not surface applied.
 - 1. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Louvers: Factory install louvers in prepared openings.

2.4 FACTORY FINISHING

- A. General: Finish doors at factory that are indicated to receive transparent finish.
- B. Grade: Premium.
- C. Finish: NWWDA I.S.1-A System TR-6 catalyzed polyurethane.
- D. Effect: Open-grain finish.
- E. Sheen: Satin.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
- B. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fixed Aluminum frame windows for exterior locations.
- B. See Division 8 Section "Glazing" for glazing requirements for aluminum windows, including those specified to be factory glazed.

1.2 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 minimum test size required by AAMA/NWWDA 101/I.S.2.
- B. 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:
 - 1. Deflection: Based on passing AAMA/NWWDA 101/I.S.2, Uniform Load Deflection Test or on glass framing system designed to limit lateral deflections of glass edges to less than 1/175 of glass-edge length at design pressure based on structural computations.
 - 2. Basic Wind Speed: As indicated in miles per hour 33 feet above grade. Determine wind loads and resulting design pressures applicable to Project according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 6.4.2, "Analytic Procedure"; based on mean roof heights above grade as indicated on Drawings.
- C. Air Infiltration: Maximum rate not more than .06 cfm/ft² when tested according to AAMA/NWWDA 101/I.S.2, Air Infiltration Test.
- D. Water Resistance: No water leakage as defined in AAMA/NWWDA referenced test methods at a water test pressure equaling 10 percent of the design pressure when tested according to AAMA/NWWDA 101/I.S.2, Water Resistance Test.
- E. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.
- F. Condensation-Resistance Factor: Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 45.
- G. Thermal Transmittance: Provide aluminum windows with a whole-window U-value maximum 55 BTU/hr/sf/EF at 15-mph (24-km/h) exterior wind velocity and winter condition temperatures when tested according to NFRC 100.

- H. 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 (67 deg C), ambient; 180 deg F (100 deg C) material surfaces.
- I. Life-Cycle Testing: Test according to AAMA 910 and comply with AAMA/NWWDA 101/I.S.2.
- J. Specific Product Performance Requirements: Comply with Section 2.2 of AAMA/NWWDA 101/I.S.2 as applicable to types of aluminum windows indicated.

1.3 SUBMITTALS

- A. Product Data: For each type of aluminum window indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other Work, and operational clearances.
 - 1. Include structural analysis data indicating structural test pressures and design pressures from basic wind speeds indicated and deflection limitations of glass framing systems, signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples: For each exposed finish.
- D. Product test reports.
- E. Maintenance data.

1.4 QUALITY ASSURANCE

- A. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
- B. 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.
- C. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace aluminum windows and doors that fail in materials and workmanship within two years from date of Substantial Completion.
- B. Warranty Period for Metal Finishes: Five years from date of Substantial Completion.
- C. Warranty Period for Glass: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

Manufacturers: Subject to compliance with requirements, provide products by:

- 1. YKK AP America, Inc.

2.2 GLAZING

- A. Glass and Glazing Materials: Refer to Division 8 Section "Glazing" for glass units and glazing requirements applicable to glazed aluminum window units.
- B. Glazing System: Glazing method shall be wet/dry type in accordance with manufacturer's standards. Exterior glazing shall be tape sealant. Glazing beads and a compression gasket of dense elastomer in accordance with ASTM C864.

2.3 FABRICATION

- A. General: Fabricate aluminum windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/NWDA 101/I.S.2 performance requirements for the following window type and performance class. Include a complete system for assembling components and anchoring windows.
 - 1. Fixed Windows: HC.
- B. Fabricate aluminum windows that are reglazable without dismantling sash or ventilator framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator.
- D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.
- F. Glazing Stops: Provide snap-on glazing stops coordinated with Division 8 Section "Glazing" and glazing system indicated. Provide glazing stops to match sash and ventilator frames.

- G. Frame units to be thermally broken.
- H. Basis of design for Aluminum windows:
 - 1. YKK AP YES 45 TU Storefront System.

2.4 FINISHES

- A. Aluminum Anodic Finish: Class I, factory-applied clear anodic coating complying with AAMA 611 (Color #17, clear).
 - 1. Color: Anodized aluminum finish.

2.5 EXECUTION

A. INSTALLATION

1. Install windows and doors level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
2. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
3. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
4. 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.
5. Adjust operating sashes and ventilators, screens, and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
6. Protect window and door 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.
7. Clean aluminum surfaces immediately after installing. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
8. 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.
9. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding Doors
 - 3. Other doors to the extent indicated.
- B. Related Sections:
 - 1. Section 08 11 13 – Hollow Metal Doors and Frames.
 - 2. Section 08 14 16 – Flush Wood Doors.
 - 3. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.
 - 4. Section 08 81 00 – Glass and Glazing.
 - 5. Section 09 90 00 – Painting and Coating.
- C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- D. Standards: All hardware specified herein shall comply with the following industry standards:
 - 1. ANSI/BHMA Certified Product Standards - A156 Series
 - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.4 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.5 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Seven years for heavy duty mortise (bored) locks and latches.
2. Five years for exit hardware.
3. Ten years for manual door closers.
4. Two years for electromechanical door hardware.

1.6 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
 1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
 - a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
 2. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
 - a. Permanent cylinders, cores, and keys to be installed by Owner.
- B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing hinges unless Hardware Sets indicate heavy weight.
 4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
 - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
 - 1) Out-swinging exterior doors.
 - 2) Out-swinging access controlled doors.
 5. Acceptable Manufacturers:
 - a. Bommer Industries (BO).
 - b. Hager Companies (HA).
 - c. McKinney Products (MK).
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.
1. Acceptable Manufacturers:
 - a. Bommer Industries (BO).

- b. McKinney Products (MK).
- c. Pemko Manufacturing (PE).
- d. Roton - Hager Hinge Co. (HA).

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a 12" removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
 - 1. Acceptable Manufacturers:
 - a. McKinney Products (MK) - SER-QC (# wires) Option.
 - b. Pemko Manufacturing (PE) - SER-QC (# wires) Option.
- B. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.
- C. Electric Door Hardware Cords: Provide electric transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
 - 1. Acceptable Manufacturers:
 - a. McKinney Products (MK) - Inner Door Cord: QC-C000P.
 - b. McKinney Products (MK) - Hinge to Junction Panel 15 feet: QC-C1500P.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 - 1. Acceptable Manufacturers:
 - a. McKinney Architectural Hardware (MK).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

- B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, 4-inches wide by 16-inches high, with square corners and beveled edges, secured with exposed screws unless otherwise indicated.
 2. Straight Pull Design: Minimum 1-inch round diameter stainless steel bar or tube stock pulls with 2 1/2-inch projection from face of door unless otherwise indicated.
 3. Offset Pull Design: Minimum 1-inch round diameter stainless steel bar or tube stock pulls with 2 1/2-inch projection and offset of 90 degrees unless otherwise indicated.
 4. Push Bars: Minimum 1-inch round diameter horizontal push bars with minimum clearance of 2 1/2-inch projection from face of door unless otherwise indicated.
 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 - a. Acceptable Manufacturers:
 - 1) McKinney Architectural Hardware (MK).
 - 2) Rockwood Manufacturing (RO).
 - 3) Trimco (TC).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU).
 - b. Best Locking Systems
- C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
 2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
- D. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:

1. Master Key System: Cylinders are operated by a change key and a master key.
- E. Key Quantity: Provide the following minimum number of keys:
 1. Top Master Key: One (1)
 2. Change Keys per Cylinder: Two (2)
 3. Master Keys (per Master Key Group): Two (2)
- F. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall expansion capacity of 150% of the number of locks required for the project.
 1. Acceptable Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF (MM).
 - c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified Mortise (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted application. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt. Locks are to be non-handed and fully field reversible.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) – ML2000 Series.
 - b. Best Locking Systems (BE) – 45H Series
- B. Lock Trim Design: As specified in Hardware Sets.

2.7 AUXILIARY LOCKS

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.5, Grade 1, certified small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DL4100 Series.
 - b. Best locking Systems (BE) – 48H Series

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
3. Dustproof Strikes: BHMA A156.16.

2.9 CONVENTIONAL EXIT DEVICES

- A. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Yale Commercial Hardware (YA) – 7100 / 7200 Series
 - c. Sargent Architectural Hardware (SA) – 80 Series

- B. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish. Provide keyed removable feature, stabilizers, and mounting brackets as specified in the Hardware Sets. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturers approved mullion and accessories to meet applicable state and local windstorm codes.

1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - 700/900 Series.
 - b. Yale Commercial Hardware (YA) – 7100 / 7200 Series
 - c. Sargent Architectural Hardware (SA) – 650A / 980S Series

2.10 ELECTROMECHANICAL CONVENTIONAL EXIT DEVICES

- A. Electrified Conventional Push Rail Devices (Heavy Duty): Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified below.

1. Acceptable Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Yale Commercial Hardware (YA) – 7100 / 7200 Series
 - c. Sargent Architectural Hardware (SA) – 80 Series

- B. Electrified Options: As indicated in hardware sets, provide electrified exit device options including: electric latch retraction, electric dogging, outside door trim control, exit alarm, delayed egress, latchbolt monitoring, lock/unlock status monitoring, touchbar monitoring and request-to-exit signaling. Unless otherwise indicated, provide electrified exit devices standard as fail secure.
- C. Electric latch retraction must be of the motorized type. Solenoid type is not acceptable.

2.11 DOOR CLOSERS

- A. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units and high impact, non-corrosive plastic covers standard.
 - 1. Acceptable Manufacturers:
 - a. Norton Door Controls (NO) – 7500 / 8000 Series.
 - b. LCN (LC) – 4000 / 1460 Series
 - B. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA 156.4, Grade 1 certified surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Unitrol arms to have door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width. Provide high impact, non-corrosive plastic covers standard.
 - 1. Acceptable Manufacturers:
 - a. Norton Door Controls (NO) - Unitrol 7500 Series.

2.12 ARCHITECTURAL TRIM

- A. Door Protective Trim
 - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
 - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
 - 3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following.
 - a. Stainless Steel: 050-inch thick.

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Acceptable Manufacturers:
 - a. McKinney Architectural Hardware (MK).
 - b. Rockwood Manufacturing (RO).
 - c. Trimco (TC).

2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Acceptable Manufacturers:
 - a. McKinney Architectural Hardware (MK).
 - b. Rockwood Manufacturing (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Acceptable Manufacturers:
 - a. Rixson Door Controls (RF).
 - b. Sargent Manufacturing (SA).

2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: :Assemblies 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 UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
 1. McKinney Weatherstripping Products (MW).
 2. Pemko Manufacturing (PE).
 3. Reese Enterprises, Inc. (RS).

2.15 ELECTRONIC ACCESSORIES

- A. Digital Keypads: Digital keypad designed for high volume use controlling entry of electrified locking devices. Fully weather proof, vandal resistant with wall type gang box or mullion mounting applications. Digital keypad system circuit board is remote mounted in a metal enclosure and provides for multiple users and digit codes, and variable programmable release times. Operates on either 12 or 24 volts AC or DC.
 1. Acceptable Manufacturers:
 - a. Securitron Door Controls (SU) - DK Series.
 - b. Corbin Russwin (RU).
- B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
 1. Acceptable Manufacturers:
 - a. Corbin Russwin (RU).

2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal,

storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set

should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. RU - Corbin Russwin
4. BE - Best Locking Systems
5. YA - Yale
6. AD - Adams Rite
7. RF - Rixson
8. NO - Norton
9. PE - Pemko
10. SD - Security Door Control
11. SU - Securitron
12. HE - HES
13. HA - Hager Co.
14. SC - Schlage

C. Contractor to provide construction cores on all locks.

Set: 1.0

Single Door: 208, 209

3 Hinge (standard weight)	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (privacy)	L Series	626	SC
1 Door Stop	406	US32D	RO
3 Silencer	608		RO
1 Core only	Final Core by Owner	Schlage Primus	Core

Set: 2.0

Single Doors: 203, 206, 224, 225, 227, 212, 216

3 Hinge (standard weight)	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (storeroom)	L Series	626	SC
1 Cylinder	1040 Mortise as req.	626	SC
1 Core Only	Final Core by Owner	Schlage Primus	Core
1 Surface Closer (Door 227 only)	4040 x P	689	LCN
3 Silencer	608		RO
1 Door Stop (Doors 212,216,206,203)	406	US32D	RO

Set: 3.0

Not Used

Set: 4.0

Single Door: 211, 217, 219, 220, 221, 228, 229

3 Hinge (standard weight)	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Lock (office)	L Series	626	SC
1 Cylinder	1040 Mortise as req.	626	SC
1 Core Only	Final Core by Owner	Schlage Primus Core	
1 Door Stop	406	US32D	RO
3 Silencer	608		RO

Set: 5.0

Single Door: 207

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Latch (passage)	L Series	626	SC
1 Door Stop	406	US32D	RO
3 Silencer	608		RO
1 Core Only	Final Core by Owner	Schlage Primus Core	

Set: 6.0

Single Doors: 222

1 Track/Hanger Set	9130-72 x 9115		HA
2 Flush Cup Pull	27P	630	HA
1 Pocket Door Edge Pull	9884	626	HA

Note: Sliding Door Closet

Set: 7.0

Single Doors: Existing Doors with Cylindrical Locks (Contractor to field verify): 201, 202, 210, 213, 214, 215, 226

1 Lock (office)	CL3551 x NZD x M08 x LC	626	RU
1 Core Only	Final Core by Owner	Schlage Primus Core	

Note: All other hardware existing.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Interior and Exterior Windows
 - 2. Doors

1.3 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. 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.
- D. 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.
- E. Deterioration of Insulating Glass: Failure of the 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.

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 thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions and confirming with manufacturer requirements. Provide glass lites for various size openings in nominal thicknesses indicated, 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 indicated on the drawings.
 - b. Maximum Lateral Deflection: For the following types of glass supported on all four edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.
 - 1) For monolithic-glass lites heat treated to resist wind loads.
 - 2) For insulating glass.
 - 3) For laminated-glass lites.
 - c. Minimum Glass Thickness for Exterior Lites: Not less than 6 mm.
 - d. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- 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 (67 deg C), ambient; 180 deg F (100 deg C), 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 laminated-glass lites, properties are based on products of construction indicated.

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- (300-mm-) square Samples for glass and of 12-inch- (300-mm-) long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

- 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.
- E. 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.
- 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. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Glass Products: Obtain glass products from one primary-glass manufacturer.
- B. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
 - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- E. Glazing for Fire-Rated Door Assemblies: Assemblies 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.
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA'S "Glazing Manual" and "Laminated Glass Design Guide."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 3. SIGMA Publications: SIGMA TM-3000, "Vertical Glazing Guidelines," and SIGMA TB-3001, "Sloped Glazing Guidelines."
- G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of one of the following inspecting and testing agencies:
1. Insulating Glass Certification Council.
 2. Associated Laboratories, Inc.
 3. National Accreditation and Management Institute.
- H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

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 (4.4 deg C).

1.9 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty on Coated-Glass Products: Written warranty, made out to Owner and signed by coated-glass manufacturer agreeing to furnish replacements for those 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: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Laminated Glass: Written warranty, made out to Owner and signed by laminated-glass manufacturer agreeing to furnish replacements for 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.
- D. Manufacturer's Special Warranty on Insulating Glass: Written warranty, made out to Owner and signed by insulating-glass manufacturer agreeing to furnish replacements for 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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. Guardian Industries Corp.
 2. Viracon, Inc.
 3. PPG Industries, Inc.

2.2 TINTED TEMPERED GLASS UNITS FOR FIXED ALUMINUM WINDOWS

- A. Tinted Tempered Glass Units:
1. Thickness: 1/4"
 2. Color: Dark Bronze on #2 Surfaces
 3. Basis of Design: Viracon, Inc.
 4. Misc: Solar screen low E VE 22M
- B. Located on the exterior side of the exterior aluminum curtain wall systems.

2.3 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select 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 for this characteristic.
- B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant.

2.4 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tape: 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 applicable products.
- B. Expanded Cellular Glazing Tape: Closed-cell, PVC foam tape; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
1. Type 1, for glazing applications in which tape acts as the primary sealant.
 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.
- B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene, ASTM C 864.
 2. EPDM, ASTM C 864.
 3. Silicone, ASTM C 1115.
 4. Thermoplastic polyolefin rubber, ASTM C 1115.
 5. Any material indicated above.
- C. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
1. Neoprene.
 2. EPDM.
 3. Silicone.
 4. Thermoplastic polyolefin rubber.
 5. Any material indicated above.

2.6 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 A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore 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. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

2.7 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products 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 standard, 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 indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

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 the length plus width is larger than 50 inches (1270 mm) 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 (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these 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. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from

extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system, unless otherwise indicated.

3.8 PROTECTION AND CLEANING

- 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 them 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 build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

SECTION 09 21 16

GYP SUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
- B. Related Sections include the following:
 - 1. Division 6, Section "Miscellaneous Rough Carpentry".

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 SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. 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."
- B. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

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. Gypsum Board and Related Products:
 - a. American Gypsum Co.
 - b. G-P Gypsum Corp.
 - c. National Gypsum Company.
 - d. United States Gypsum Co.

2.2 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. Gypsum Wallboard: ASTM C 36.
 - 1. Regular Type:
 - a. Thickness: 5/8 inch.
 - b. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead (J-Bead): Use at exposed panel edges.
 - c. L-Bead: Use where indicated.
 - d. U-Bead: Use where indicated.
 - e. Expansion (Control) Joint: Use where required.
 - f. Tear-away bead.

2.4 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 drying-type, all-purpose compound.
 - 3. Use setting-type compound for installing paper-faced metal trim accessories.
 - 4. Fill Coat: For second coat, use setting-type, sandable topping compound .
 - 5. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 6. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.5 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.
- C. Fastening Adhesive:
 - 1. Wood: ASTM C 557.
 - 2. Steel: Adhesive recommended for attaching panels to steel framing.
- D. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

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 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. 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.
- C. 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.
- D. Attach gypsum panels to studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- E. Attach gypsum panels to framing provided at openings and cutouts.
- F. 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.
- G. Form control and expansion joints with space between edges of adjoining gypsum panels.
- H. 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.

3.3 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 horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 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.

3.5 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, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 - 1. 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.

END OF SECTION

SECTION 09 51 23

ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceilings consisting of acoustical tiles and lay-in suspension systems.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Product Test Reports: Indicate compliance of acoustical tile ceilings and components with requirements based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical tile ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling tile from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
 - 1. Obtain both acoustical ceiling tiles and suspension system from the same manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile 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 tiles and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
 - 2. Suspension System Components: Quantity of each grid and exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL CEILING TILE TYPES

- A. Acoustical Ceiling Tile:
 - 1. Basis of Design: USG: Millenia Climaplus Illusion TWO/24

2.2 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. USG Interiors, Inc.

2.3 ACOUSTICAL TILES, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- B. Antimicrobial Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution consisting of a synergistic blend of substituted ammonium salts of alkylated phosphoric acids admixed with free alkylated phosphoric acid that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
 - 1. Postinstalled Anchors in Existing Plaster Ceiling: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled expansion anchors.
 - b. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 alloy 304 or 316 for bolts; alloy 304 or 316 for anchor.
 - 2. Postinstalled Powder-Actuated Fasteners in Existing Plaster Ceiling: 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.
- D. 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.
- E. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.
- G. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's product designations, including splice plates, corner pieces, and attachment and other clips, complying with the following requirements:
 - 1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221/B 221M for alloy and temper 6063-T5.

2. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Comply with paint manufacturer's written instructions for applying and baking and for minimum dry film thickness.
 - a. Organic Coating: Manufacturer's standard thermosetting coating system with a minimum dry film thickness of 0.8 to 1.2 mils (0.02 to 0.03 mm).
 - b. Color: As selected by Architect from manufacturer's standard colors.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. USG Interiors, Inc.

2.5 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
 1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. PL Acoustical Sealant; ChemRex, Inc., Contech Brands.
 - b. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
 - c. SHEETROCK Acoustical Sealant; United States Gypsum Co.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical tile ceilings.
 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other Sections.

1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordinating other work.
- B. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- C. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical tile ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
- 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. Splay hangers only where required and, if permitted with fire-resistance rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 4. 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.
 5. 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; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Arrange directionally patterned acoustical tiles as follows:
 - 1. Install tiles with pattern running in one direction parallel to long axis of space.
- F. Install acoustical tiles in coordination with suspension system. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
 - 1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
 - 2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches (305 mm) o.c.
 - 3. Fabricate access units for special suspension system access members and tile units modified as required to allow for removal of access units.
 - 4. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical tile ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Resilient wall base and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).
- C. Store tiles on flat surfaces.
- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install tiles and accessories after other finishing operations, including painting, have been completed.
- E. Where demountable partitions and other items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than one box for each 50 boxes or fraction thereof, of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.
 - 2. Furnish not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
 - 3. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 RESILIENT ACCESSORIES

- A. Vinyl Wall Base: 6" high coved, 1/8" thick.
 - 1. Manufacturer: Burke Mercer
 - 2. Color: Navy 875 (Night Navy)

2.2 INSTALLATION ACCESSORIES

- A. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- 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 flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 3. Do not stretch base during installation.
 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 5. Install premolded outside and inside corners before installing straight pieces.
- C. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 2. Sweep or vacuum floor thoroughly.
 3. Do not wash floor until after time period recommended by flooring manufacturer.
 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other 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 flooring manufacturer.
1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to flooring manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
 3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
 2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Vinyl composition floor tile.
 - 2. Resilient wall base and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Maintenance Data: For resilient floor tile to include in the maintenance manuals specified in Division 1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type, color, and pattern of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
 - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).
- C. Store tiles on flat surfaces.
- D. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post-installation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.
- D. Install tiles and accessories after other finishing operations, including painting, have been completed.
- E. Where demountable partitions and other items are indicated for installation on top of resilient tile flooring, install tile before these items are installed.
- F. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than one box and one additional for each 50 boxes or fraction thereof, of each type, color, pattern, class, wearing surface, and size of resilient tile flooring installed.
 - 2. Furnish not less than 10 linear feet (3 linear m) and 10 additional for each 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient accessory installed.
 - 3. Deliver extra materials to Owner.

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. Armstrong World Industries, Inc. (Tile)
 - 2. Burke Mercer (Wall Base)

2.2 RESILIENT TILE

- A. Vinyl Composition Floor Tile
 - 1. Color: 51933 Blue Cloud

2.3 RESILIENT ACCESSORIES

- A. Vinyl Wall Base: Refer to Section 09 65 13

2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving resilient flooring.

3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Install 1/4" Luan plywood under all VCT unless existing substrate meets manufacturer warranty requirements.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with resilient product manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Use stair-tread-nose filler, according to resilient tread manufacturer's written instructions, to fill nosing substrates that do not conform to tread contours.
- D. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- E. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

- A. General: Comply with tile manufacturer's written installation instructions.
- B. 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 of a tile at perimeter.
 1. Lay tiles square with room axis, unless otherwise indicated.
- C. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- E. Extend tiles into toe spaces, door reveals, closets, and similar openings.

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent, nonstaining marking device.
- G. 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 flooring installed on covers. Tightly adhere edges to perimeter of floor around covers and to covers.
- H. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
 - 1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Hand roll tiles according to tile manufacturer's written instructions.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. General: Install resilient accessories according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Install premolded outside and inside corners before installing straight pieces.
- C. Place resilient accessories so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.
- D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

3.5 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.

2. Sweep or vacuum floor thoroughly.
 3. Do not wash floor until after time period recommended by flooring manufacturer.
 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other 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 flooring manufacturer.
1. Apply protective floor polish to floor surfaces that are free from soil, visible adhesive, and surface blemishes, if recommended in writing by manufacturer.
 - a. Use commercially available product acceptable to flooring manufacturer.
 - b. Coordinate selection of floor polish with Owner's maintenance service.
 2. Cover products installed on floor surfaces with undyed, untreated building paper until inspection for Substantial Completion.
 3. Do not move heavy and sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.
- C. Clean floor surfaces not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
1. Before cleaning, strip protective floor polish that was applied after completing installation only if required to restore polish finish and if recommended by flooring manufacturer.
 2. After cleaning, reapply polish to floor surfaces to restore protective floor finish according to flooring manufacturer's written recommendations. Coordinate with Owner's maintenance program.

END OF SECTION

SECTION 09 68 00

CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 1. Carpet tile, installed over concrete slabs.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 1. Carpet: 12-inch- (300-mm-) square Sample.
 2. Exposed Edge Stripping and Accessory: 12-inch- (300-mm-) long Samples.
- C. Product Schedule: Use same room and product designations indicated on Drawings and in schedules.
- D. Maintenance Data: For carpet to include in maintenance manuals specified in Division 1. Include the following:
 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with CRI 104, Section 5, "Storage and Handling."

1.6 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."
- B. Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

1.8 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. Carpet: 2 percent of amount installed for each type indicated, but not less than 50 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide products by the following or approved equal:
 - 1. Interface Flor

2.2 INSTALLATION ACCESSORIES

- B. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:
 - 1. Carpet manufacturer.
- A. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following:
 - 1. Carpet manufacturer.
- B. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

2.3 CARPET TYPES

- A. The following or approved equal:
 - 1. Interface Flor: "Profile", Style #13811
 - 2. Color: #5975 Dimension, non-directional pattern

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:
 - a. Carpet manufacturer.
 - 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. 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 the following:
 - 1. Carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Solvent-free adhesive.
- B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."

- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION

SECTION 09 91 23

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For each type of finish-coat material indicated. Provide color fans

1.3 QUALITY ASSURANCE

- A. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5.
 - 1. Wall & Ceiling Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m).
 - 2. Doors & Frames: Mockup on at least (1) of each.
 - 3. Final approval of colors will be from benchmark samples.

1.4 PROJECT CONDITIONS

- A. Store materials not in use in tightly covered containers in a well ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
- B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).
- C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

1.5 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
 - 1. Quantity: 5 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide the basis of design products listed in other Part 2 articles, from ICI Dulux Paints, or equal from the following manufacturers:
1. Benjamin Moore & Co. (Benjamin Moore).
 2. ICI Paint Stores, Inc. (Dulux Paint and BuildTex Paint).
 3. M. A. Bruder & Sons, Inc. (M. A. B. Paint).
 4. PPG Industries, Inc. (Pittsburgh Paints).
 5. Sherwin-Williams Co. (Sherwin-Williams).

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.
- C. Colors:
1. Interior & Exterior: As selected from manufacturer's standard whites range.

2.3 PREPARATORY COATS

- A. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
 2. Zinc-Coated Metal Substrates: Galvanized metal primer.
 3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

2.4 EXTERIOR FINISH COATS

- A. Exterior Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).
1. Devco: 1502 Wonder-Shield Exterior Acrylic Latex House Paint Primer.
 2. Fuller: 200-17 Pigmented Concrete and Masonry Primer Sealer.
 3. Glidden: 6700 Series Spred Ultra Exterior Satin Latex House and Trim Paint Thinned with one-half pint (0.237 L) of water per 1 gal. (3.785 L).
 4. Moore: Moore's Latex Exterior Primer #102.
 5. PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
 6. P&L: Z/F 1001 Suprime 1 Multi-Purpose 100 Percent Acrylic Primer.
 7. Approved equal.

- B. First and Second Coats: Low-luster (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils (0.058 mm).

1. Devoe: 16XX Wonder-Shield Exterior Acrylic Latex Satin House and Trim Paint.
2. Fuller: 261-XX Eggshell Sheen Latex House and Trim Paint.
3. Glidden: 6700 Series Spred Ultra Exterior Satin Latex House and Trim Paint.
4. Moore: MoorGard Latex House Paint #103.
5. PPG: 76 Line Sun-Proof Exterior House & Trim Acrylic Satin Latex.
6. P&L: Z/F 1800 Series Aqua-Shell Exterior Latex Eggshell Paint.
7. Approved equal.

2.5 INTERIOR FINISH COATS

- A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

- a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

- 1.) Devoe: 50801 Wonder-Tones Interior Vinyl Latex Primer-Sealer.
- 2.) Fuller: 220-20 Pro-Tech Interior Latex Wall Primer and Sealer.
- 3.) Glidden: 5111 Spred Ultra Latex Primer-Sealer.
- 4.) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
- 5.) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
- 6.) P & L: Z/F 1004 Suprime "4" Interior Latex Wall Primer.

- b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils (0.071 mm).

- 1.) Devoe: 34XX Wonder-Tones Interior Latex Eggshell Enamel.
- 2.) Fuller: 212-XX AA Enamel Acrylic Latex Eggshell Enamel.
- 3.) Glidden: 4100 Series Spread Ultra Eggshell Latex Wall & Trim Paint.
- 4.) Moore: Moore's Regal AquaVelvet #319.
- 5.) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
- 6.) P & L: Z/F 4000 Series Accolade Interior Velvet.

- B. Woodwork and Hardboard: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Alkyd-Enamel Finish: 2 finish coats over a primer.

- a. Primer: Alkyd or latex-based, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

- 1.) Devoe: 51701 Wonder-Prime All-Purpose Latex Primer Sealer & Vapor Barrier.

- 2.) Fuller: 220-07 Interior Alkyd Enamel Undercoat.
 - 3.) Glidden: UH 400 Ultra-Hide Alkyd Interior Enamel Undercoater.
 - 4.) Moore: Moore's Alkyd Enamel Underbody #217.
 - 5.) PPG: 17-255 Quick-Drying Enamel Undercoater.
 - 6.) P & L: S/D 1011 Suprime "11" Interior Alkyd Wood Primer.
 - 7.) S-W: ProMar 200 Alkyd Enamel Undercoater B49W200.
- b. First and Second Coats: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils (0.061 mm).
- 1.) Devoe: 26XX Velour Interior Alkyd Semi-Gloss Enamel.
 - 2.) Fuller: 110-XX Fullerglo Alkyd Semi-Gloss Enamel.
 - 3.) Glidden: UH 8400 Ultra Traditional Alkyd Semi-Gloss Enamel.
 - 4.) Moore: Satin Impervo #235.
 - 5.) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
 - 6.) P & L: S/D 5700 Cellu-Tone Alkyd Satin Enamel.
 - 7.) S-W: Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series.
- c. Ferrous Metal: Provide the following finish systems over metal surfaces. Primer is not required on shop primed items.
- 1.) Semigloss, Acrylic-Enamel Finish: 2 finish coats over a galvanized metal primer.
 - (a) Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).
 - i. Devoe: 8502/8520 Mirrolac - WB Interior/Exterior Waterborne Flat DTM Primer and Finish.
 - ii. Fuller: 621-05 Blox-Rust Latex Metal Primer.
 - iii. Glidden: 5205 Glid-Guard Tank & Structural Primer, Red.
 - iv. Moore: IronClad Galvanized Metal Latex Primer #155.
 - v. PPC: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
 - vi. P & L: Z/F 1003 Suprime "3" Interior/Exterior Latex Metal Primer.
 - (b) First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at a spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm) .
 - i. Devoe: 17XX Wonder-Shield Semi-Gloss Exterior

- Acrylic Later House and Trim Paint.
- ii. Fuller: 664-XX Weather King II Semi-Gloss House & Trim Paint.
- iii. Glidden: 6600 Series Spred Ultra Exterior Gloss Latex House & Trim Paint.
- iv. Moore: MoorGlo Latex House & Trim Paint #096.
- v. PPC: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
- vi. P & L: Z/F 3100 Series Aqua Royal Latex House & Trim Finish.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
- 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.
- C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. Verify that existing doors to be painted have been patched and prepared for new hardware sets accordingly.
- D. 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: 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.
 - 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.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
 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.
- E. Material Preparation:
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.
- F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector 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.
1. 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.
 2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 5. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
- G. Sand lightly between each succeeding enamel or varnish coat.
- H. 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. Omit primer over metal surfaces that have been shop primed and touchup painted.
 2. 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.
- I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

- J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- L. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- M. 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.
- N. 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.
- O. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

3.2 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. 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.
- C. 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.

3.3 COLOR SCHEDULE

- A. Walls: Sherwin Williams, Color: SW7135 Twinkle, satin finish.
- B. Door Trim at Metal Doors: Sherwin Williams, Color: SW7068 Grizzle Gray, semi-gloss finish.
- C. Door Trim at Wood Doors: Sherwin Williams, Color: Selected by owner to match wood door.

END OF SECTION

SECTION 12 21 00

WINDOW BLINDS

PART 1 - GENERAL

1.1 SUBMITTALS

Submit the following:

SD-03 Product Data
Window Blinds
Installation
Certification

SD-04 Samples
Window Blinds

SD-08 Manufacturer's Instructions
Window Blinds

SD-10 Operation and Maintenance Data
Window Blinds

1.2 SYSTEM DESCRIPTION

Provide window treatment, conforming to NFPA 701, complete with necessary brackets, fittings, and hardware. Mount and operate equipment in accordance with manufacturer's instructions. Windows to receive a treatment shall be completely covered.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver components to the jobsite in the manufacturer's original packaging with the brand or company name, item identification, and project reference clearly marked. Store components in a dry location that is adequately ventilated and free from dust, water, or other contaminants and has easy access for inspection and handling. Store materials flat in a clean dry area with temperature maintained above 50 degrees F. Do not open containers until needed for installation unless verification inspection is required.

1.4 WARRANTY

Provide manufacturer's standard limited lifetime warranties that apply and standard 3 year warranty on the entire system.

PART 2 - PRODUCTS

2.1 WINDOW BLINDS

Provide each blind, including hardware, accessory items, mounting brackets and fastenings, as a complete unit produced by one manufacturer. All parts shall be one color, unless otherwise indicated, to match the color of the blind slat. Treat steel features for corrosion resistance. Submit samples of each type and color of window treatment. Provide vinyl horizontal louver blind slats 6 inch in length for each color. Provide 6 inch sample of horizontal blind slats in each color specified. Also submit results of Fire resistance, Flame Spread, and Smoke contribution tests.

2.1.1 Horizontal Blinds

Provide horizontal blinds with 2 inch slats. Blind units shall be capable of nominally 180 degree partial tilting operation and full-height raising. Blinds shall be outside mount. Provide tapes for 2 inch slats with longitudinal reinforced vinyl plastic in 1-piece turn ladder construction. Tapes for 1 inch slats shall be braided polyester or nylon.

2.1.1.1 Head Channel and Slats

Provide head channel made of steel or aluminum with corrosion-resistant finish nominal 0.018 inch for 2 inch slats. Provide slats of vinyl, not less than 3/32 (.09375) inch thick, and of sufficient strength to prevent sag or bow in the finished blind. Provide a sufficient amount of slats to assure proper control, uniform spacing, and adequate overlap. Enclose all hardware in the headrail.

2.1.1.2 Controls

The slats shall be tilted by a transparent tilting wand, hung vertically by its own weight, and shall swivel for easy operation. Provide a tilter control of enclosed construction. Provide moving parts and mechanical drive made of compatible materials which do not require lubrication during normal expected life. The tilter shall tilt the slats to any desired angle and hold them at that angle so that any vibration or movement of ladders and slats will not drive the tilter and change the angle of slats. Include a mechanism to prevent over tightening. Provide a wand of sufficient length to reach to within 5 feet of the floor.

2.1.1.3 Bottom Rail

Provide bottom rail made of corrosion-resistant steel with factory applied finish. Provide closed oval shaped bottom rail with double-lock seam for maximum strength. Bottom rail and end caps to match slats in color.

2.1.1.4 Braided Ladders

Provide braided ladders of 100 percent polyester yarn, color to match the slat color. Space ladders 15.2 slats per foot of drop in order to provide a uniform overlap of the slats in a closed position.

2.1.1.5 Hold-Down Brackets

Provide universal type hold-down brackets for sill or jamb mount.

2.1.1.6 Audio Visual Blinds

In addition to requirements for blinds, each unit shall include light traps at sides, and sill.

2.2 COLOR

Provide color, pattern and texture as selected by Owner from manufacturer's standard colors.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify all dimensions in the field, and advise the Owner's representative of any discrepancy before performing the work.

3.3.1 Horizontal and Audio Visual Blinds

Perform installation of Horizontal Blinds in accordance with manufacturer's installation instructions. Install units level, plumb, secure, and at proper height and location relative to window units. Provide and install supplementary or miscellaneous items in total, including clips, brackets, or anchorages incidental to or necessary for a sound, secure, and complete installation. Do not start installation until completion of room painting and finishing operations.

3.2 CLEAN-UP

Upon completion of the installation, free window treatments from soiling, damage or blemishes; and adjust them for form and appearance and proper operating condition. Repair or replace damaged units as directed by the Owner's representative. Isolate metal parts from direct contact with concrete, mortar, or dissimilar metals. Ensure blinds installed in recessed pockets can be removable without disturbing the pocket. The entire blind, when retracted, shall be contained behind the pocket. For blinds installed outside the jambs and mullions, overlap each jamb and mullion 0.75 inch or more when the jamb and mullion sizes permit. Include all hardware, brackets, anchors, fasteners, and accessories necessary for a complete, finished installation.

END OF SECTION

SECTION 12 21 16

VERTICAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Vertical louver blinds.

1.2 SUBMITTALS

- A. Samples: For each exposed finish.
- B. Product certificates.
- C. Maintenance data.

1.3 QUALITY ASSURANCE

- A. Product Standard: Provide vertical louver blinds complying with WCSC A 100.1.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name.

PART 2 - PRODUCTS

2.1 VERTICAL LOUVER BLINDS, FABRIC VANES

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Springs Window Fashions Division, Inc.; Graber G-85 Dura-Vue Vertical Blinds.
- B. Rail System: Headrail Dual system with headrail and bottom rail.
 - 1. Rails: Formed steel; long edges returned or rolled; channel-shaped, enclosing operating mechanisms.
 - 2. Color: As selected by Owner from manufacturer's standard color range.
- C. Vanes: PVC-coated polyester mesh, freehanging fabric with hemmed, nonraveling edges; stain and fade resistant; with not less than overlap when vanes are rotated fully closed.

- 1. Nominal Vane Width: 3-1/2 inches (89 mm).
- D. Vane Directional Control: Manual.
- E. Traversing Control: Manual.
- F. Draw and Stack Position: Off center, controls right.
- G. Cord-Tensioner Mounting: Wall.
- H. Valance: Two-tiered vane insert with dust cover. Fabric vane insert matching vanes.
- I. Louver Bottom: Connecting or spacing chains.
- J. Mounting: Mounted at existing window head extension.
- K. Stack Release: Permitting stacked vanes to be moved away from stacking position for total access to glazed opening.
- L. Fabric Colors, Textures, and Patterns: As selected by Owner from manufacturer's full range

2.2 VERTICAL LOUVER BLIND FABRICATION

- A. Product Description: Vertical louver blind consisting of equally spaced, synchronized vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware.
- B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.
 - 1. Louver Directional and Traversing Control Mechanisms: With permanently lubricated moving parts.
- C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows:
 - 1. Blind Units Installed between (inside) Jambs: Width equal to per side or total less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to , plus or minus , 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, valance, and operating hardware, and for hardware position and blind mounting method indicated.
- E. Installation Fasteners: No 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 metal components exposed to view, unless anodized or plated

finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install vertical louver blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior vane edges in any position are not closer than 4 inches (51 mm) 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.
- B. Jamb Mounted: Install headrail flush with face of opening jamb and head.
- C. Head Mounted: Install headrail on face of opening head.
- D. Adjust vertical louver blinds to operate smoothly, easily, safely and free of binding or malfunction throughout entire operational range.
- E. Clean vertical louver blind surfaces after installation, according to manufacturer's written instructions.

END OF SECTION

SECTION 12 30 00

CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Cabinets.
 - 2. Solid-surfacing-material countertops.

1.2 SUBMITTALS

- A. Product Data: For cabinets and countertop material.
- B. Shop Drawings: For cabinets and countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, hardware, edge and backsplash profiles, methods of joining countertops, and cutouts for plumbing fixtures.
- C. Samples: For each type of material exposed to view.

1.3 QUALITY ASSURANCE

- A. Quality Standards: Unless otherwise indicated, comply with the following standards:
 - 1. Cabinets: KCMA A161.1 and/or AWI Custom Grade Standards.
 - a. KCMA Certification: Provide cabinets with KCMA's "Certified Cabinet" seal affixed in a semiexposed location.
 - 2. Plastic-Laminate Countertops: KCMA A161.2 and/or AWI Custom Grade Standards.

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

- A. General:
 - 1. Adhesives: Do not use adhesives that contain urea formaldehyde.
 - 2. Hardwood Lumber: Kiln dried to 7 percent moisture content.
 - 3. Softwood Lumber: Kiln dried to 10 percent moisture content.
 - 4. Hardwood Plywood: HPVA HP-1.
 - 5. Particleboard: ANSI A208.1, Grade M-2.
 - 6. Medium-Density Fiberboard: ANSI A208.2, Grade MD.

7. Hardboard: AHA A135.4, Class 1 Tempered.

B. Exposed Materials:

1. Solid Wood: Clear hardwood lumber of species indicated, free of defects.

C. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Plastic Laminate: Particleboard faced with high-pressure decorative laminate complying with NEMA LD 3, Grade VGS.

a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

2. Vinyl-Faced Particleboard: Medium-density particleboard with embossed vinyl film adhesively bonded to particleboard.

a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.2 COUNTERTOP MATERIALS

A. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

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:

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

- a. Avonite, Inc.
- b. E. I. du Pont de Nemours and Company.
- c. Formica Corp.
- d. Meganite
- e. Swan Corporation (The).
- f. Wilsonart International.
- g. Approved equal.

3. Type: Provide Standard Type, unless Special Purpose Type is indicated.

4. Colors and Patterns: As selected by Architect from manufacturer's full range.

B. Particleboard: ANSI A208.1, Grade M-2.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.3 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: Bevel.
 - 2. Integral Backsplash
- B. Countertops: 1/2-inch- (19-mm-) thick, solid-surfacing material with built-up edges.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B. Install cabinets without distortion so doors and drawers fit openings and are aligned. Complete installation of hardware and accessories as indicated.
- C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m).
- D. Fasten solid-surfacing-material countertops by screwing through corner blocks of base units into underside of countertop. Align adjacent surfaces, and form seams to comply with manufacturer's written instructions using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

END OF SECTION

SECTION 16720 - FIRE ALARM SYSTEM

PART I. - GENERAL

A. GENERAL REQUIREMENTS

1. The work required under this Section shall conform to the requirements of "Division I, General Requirements," "Conditions of the Contract" and "Supplementary Conditions." Specific attention is called to the "Mechanical and Electrical General Requirements" Sections of the specifications.
2. All related work specified in other Sections shall be properly coordinated with the fire alarm system.
3. System shall be an extension of the existing building Honeywell Silent Knight system IFP2000.
4. Installer's Qualifications: Firms specializing and experienced in addressable, electronic fire alarm system installations for not less than 5 years. Firms shall have in-place within ninety (90) miles by roadway of project site a support facility with necessary technical staff, spare parts inventory, test and diagnostic equipment.

B. WORK INCLUDED

1. Design, furnish and install a complete Fire Alarm Systems as required to provide initiation and alarm for life safety per NFPA codes and Delaware State Fire Prevention Regulations. System shall be complete and wired, connected, and left in a first class operating condition. All equipment shall be listed by the Underwriters' Laboratories.

C. CODES AND STANDARDS

1. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.
2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
3. NFPA Compliance: Comply with NFPA 70, NFPA 72, and NFPA 101.
4. Delaware State Fire Prevention Regulations: Fire alarm system installer shall be certified and licensed by the State of Delaware.

D. SUBMITTALS

1. Manufacturers' product and system literature and illustrations.
2. A description of the system operation which includes the method of operation and supervision of each type of circuit (alarm initiation, signaling, control annunciation, etc.), operation of manual controls, and sequence of automatic and manual operation. The system description shall be written specifically for this project. The manufacturer's standard descriptions which refer only to general operation are not acceptable.
3. Wiring diagrams showing all devices and equipment and the method of wiring for each type of circuit for each function performed

4. Installation and operating instructions. provide copies for inclusion in the O&M manuals.
5. Submit fire alarm shop drawings to the Office of the Delaware State Fire Marshal, the authority having jurisdiction. Include copies of the floor plans to depict component locations to facilitate reviews. Upon receipt of comments from the authority, submit a copy of the marked up submittal for review by the Engineer. Make resubmission to the authority, if required to make clarifications of revisions and/or to obtain approval.

PART II. - EQUIPMENT AND SYSTEMS

A. SYSTEM OPERATION

1. The Fire Alarm System shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Manufacturer's standard control switches shall provide the required operation, including performance, supervision, and position indication. Operation of any approved initiating device of alarm, trouble, and supervisory shall cause audible signals to sound on a continuous basis, flash all visual alarms, indicate initiating device and zone on the annunciator, and remain in alarm condition until the initiating device and control panel are reset to normal.
2. Fire alarm system equipment shall be Honeywell Silent Knight products, compatible with the existing building IFP2000 system, which constitute the type and quality of the equipment to be used.

PART III. - EXECUTION

A. INSTALLATION

1. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring, if installed in conduit, shall be in a completely separate conduit system. Wiring shall be installed in strict compliance with all the provisions of NEC - Article 760, Power-Limited Protective Signaling Circuits.

All junction boxes shall be sprayed red and labeled "Fire Alarm." Wiring color code shall be maintained throughout the installation.

2. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.
3. The contractor shall clean all dirt and debris from the inside and the outside of the fire alarm equipment after completion of installation.

B. TESTING

1. The completed fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.

C. WARRANTY

1. The contractor shall warrant the installed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION 16720

SECTION 15010 - BASIC MECHANICAL REQUIREMENTS

PART I.- GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 15.

B. SUMMARY

1. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:
 - a. Submittals.
 - b. Record documents.
 - c. Maintenance manuals.
 - d. Project Acceptance and Guarantee.
 - e. Rough-ins.
 - f. Mechanical installations.
 - g. Cutting and patching.

C. SUBMITTALS

1. Submit the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution.

D. RECORD DOCUMENTS

1. Prepare record documents. Record documents shall include two sets of full sized, "as-built" construction drawings; one CD with PDF images of "as-built" drawings; and one DVD of the on-site demonstration of equipment operation and service. Indicate the following installed conditions:
 - a. Ductwork mains and branches, size and location; locations of dampers and other control devices; filters and terminal units requiring periodic maintenance or repair.
 - b. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.
 - c. Contract Modifications, actual equipment and materials installed.

E. MAINTENANCE MANUALS

1. Prepare maintenance manuals. Include the following information for equipment items:
 - a. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - b. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and

emergency instructions; and summer and winter operating instructions.

- c. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
- d. Servicing instructions and lubrication charts and schedules.

F. PROJECT ACCEPTANCE AND GUARANTEE

- 1. When the work is substantially completed and all systems are operational, the Contractor shall notify the Owner and the Architect that the work will be ready for final inspection. The Owner, Engineer, and Contractor shall schedule the final inspection.
- 2. After the inspection, if the Owner and Engineer find the work substantially complete and the project can be occupied for its intended purpose, then the date of substantial completion and project acceptance shall be set, and the guarantee period shall begin.
- 3. The Contractor guarantees for a one (1) year period beginning on the established date of acceptance that:
 - a. The work is in conformance with the Contract Documents. The work contains no faulty or defective material or equipment and no careless, unskilled or defective workmanship.
 - b. All material and equipment are adequate for their intended use and shall operate satisfactorily and efficiently (so long as recommended maintenance is performed).
 - c. Any work found to be not as guaranteed shall be corrected, repaired or replaced without cost to the Owner. This shall extend to all damages caused to other work or materials in the process of complying with this Section.
- 4. Manufacturer's guarantees and warranties shall remain in force. Certificates of manufacturer's guarantees shall be given to the Owner at the start of the guarantee period.

G. DELIVERY, STORAGE, AND HANDLING

- 1. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

H. ROUGH-IN

- 1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- 2. Confirm location and size of all existing pipe, ductwork, structure, and site utilities prior to commencing work. Inform Owner and Architect of any irregularities.

I. MECHANICAL INSTALLATIONS

- 1. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

- a. Coordinate mechanical systems, equipment, and materials installation with other building components.
- b. Verify all dimensions by field measurements.
- c. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
- d. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
- e. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Provide required connection for each service.
- f. Install systems, materials, and equipment to conform with approved submittal data. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
- g. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
- h. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

J. CUTTING AND PATCHING

- 1. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- 2. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- 4. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 15010

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

PART I. - GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
 - a. Piping materials and installation instructions common to most piping systems.
 - b. Equipment nameplate data requirements.
 - c. Labeling and identifying mechanical systems and equipment.
 - d. Field-fabricated metal and wood equipment supports.
 - e. Access panels and doors.
 - f. Fire-stopping.
 - g. Installation requirements common to equipment specification Sections.
 - h. Mechanical demolition.
 - i. Cutting and patching.
 - j. Touchup painting and finishing.
2. Pipe and pipe fitting materials are specified in piping system Sections.

C. DEFINITIONS

1. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
2. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
3. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
4. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
5. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

D. SUBMITTALS

1. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
2. Product data for following piping specialties:

- a. Mechanical sleeve seals.
 - b. Identification materials and devices.
 - c. Access panels and doors.
 - d. Fire-stopping.
3. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
 4. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

E. QUALITY ASSURANCE

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
 - a. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.
2. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.
3. Single Source: Furnish all like equipment from one manufacturer. In particular single source responsibility shall be provided for HVAC Units, valves, and controls.

F. DELIVERY, STORAGE, AND HANDLING

1. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
2. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

G. SEQUENCING AND SCHEDULING

1. Coordinate mechanical equipment installation with other building components.
2. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
3. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.

4. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.
5. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

PART II. - PRODUCTS

A. PIPE AND PIPE FITTINGS

1. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
2. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

B. JOINING MATERIALS

1. Refer to individual piping system specification Sections in Division 15 for special joining materials not listed below.
2. Solder Filler Metal: ASTM B 32.
 - a. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10 percent lead content.
 - b. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10 percent maximum lead content.

C. PIPING SPECIALTIES

1. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
 - a. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
 - b. Insulating Material: Suitable for system fluid, pressure, and temperature.
 - c. Dielectric Unions: Factory-fabricated, union assembly for 250-psig (1725kPa) minimum working pressure at a 180 deg F (82 deg C) temperature.
 - d. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - (1) Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035kPa or 2070kPa) minimum working pressure to suit system pressures.
 - e. Dielectric Couplings: Galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig (2070kPa) minimum working pressure at 225 deg F (107 deg C) temperature.

- f. Dielectric Nipples: Electroplated steel nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070kPa) working pressure at 225 deg F (107 deg C) temperature.

D. IDENTIFYING DEVICES AND LABELS

- 1. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. Where more than one type is specified for listed application, selection is Installer's option, but provide single selection for each product category.
- 2. Equipment Nameplates: Metal nameplate with operational data engraved or stamped, permanently fastened to equipment.
 - a. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
 - b. Location: An accessible and visible location.
- 3. Snap-On Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid snap-on, color-coded pipe markers, direction of flow indication, conforming to ASME A13.1.
- 4. Painted Stencil Markings: solid spray enamel paint, color coded, with direction of flow indication.
- 5. Valve Tags: Manufacturer's standard stamped brass disc on chain.

E. ACCESS PANELS AND DOORS

- 1. Drywall ceilings: High impact polystyrene plastic with pivot hinged removable door, snap friction latch, white textured surface suitable for painting or covering. Frame installs by caulk or glue onto drywall surface. Karp Associates, inc Model HA Plastic Panel, or equal.
- 2. Masonry substrates and walls: 16 gauge steel door, 14 gauge steel 3/4" wide one-piece frame, concealed piano hinge, flush lock with stainless steel cam, prime coat baked enamel finish. Karp Associates, inc Model DSC-214M, or equal.

F. FIRE-STOPPING

- 1. Fire-Resistant Sealant: Provide water based acrylic, intumescent, fire-stopping sealant formulated for use in a through-penetration fire-stop system for filling openings around pipe, wire or duct penetrations through walls and floors, having fire-resistance ratings up to four (4) hours. Fire-stopping assemblies shall be tested per ASTM E 84, ASTM E 814, and Underwriters Laboratory, Inc. 1479; shall be FM approved; and meets LEED requirements for indoor environmental quality. Flame spread shall be zero (0) and smoke development of five (5). Fire-stopping system shall be complete with mineral wool backing.
- 2. Products: Subject to compliance with requirements, provide one of the following:

- a. Dow Corning Fire Stop Sealant
- b. Hilti FS-One
- c. 3M Fire Barrier Caulk
- d. Fyre Putty Standard Oil Engineered Materials Co.

PART III. - EXECUTION

A. PIPING SYSTEMS--COMMON REQUIREMENTS

- 1. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15 specify piping installation requirements unique to the piping system.
- 2. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.
- 3. Install piping at indicated slope.
- 4. Install components having pressure rating equal to or greater than system operating pressure.
- 5. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.
- 6. Install piping free of sags and bends.
- 7. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- 8. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.
- 9. Install piping to allow application of insulation plus 1-inch (25mm) clearance around insulation.
- 10. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- 11. Install fittings for changes in direction and branch connections.
- 12. Install couplings according to manufacturer's printed instructions.
- 13. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.
 - a. Cut sleeves to length for mounting flush with both surfaces.
 - (1) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure

clamping ring where specified.

- b. Build sleeves into new walls and slabs as work progresses.
 - c. Install large enough sleeves to provide 1/4-inch (6mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - (1) Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).
 - (2) Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal."
 - d. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants.
14. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material.
15. Verify final equipment locations for roughing in.
16. Refer to equipment specifications in other Sections for roughing-in requirements.
17. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system Sections.
- a. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
 - b. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
 - c. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
 - d. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
 - (1) Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - (2) Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
 - (3) Align threads at point of assembly.
 - (4) Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
 - (5) Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
18. Piping Connections: Except as otherwise indicated, make piping connections as specified below.

- a. Install unions in piping 2 inches (50 mm) and smaller adjacent to each valve and at final connection to each piece of equipment having a 2-inch (50mm) or smaller threaded pipe connection.
- b. Wet Piping Systems (Water): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

B. EQUIPMENT INSTALLATION--COMMON REQUIREMENTS

1. Install equipment to provide the maximum possible headroom where mounting heights are not indicated.
2. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.
3. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
4. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
5. Install equipment giving right-of-way to piping systems installed at a required slope.

C. LABELING AND IDENTIFYING

1. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
 - a. Plastic markers, with application systems. Install on pipe insulation segment where required for hot pipes.
 - b. Locate pipe markers wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces and exposed exterior locations.
2. Duct Systems: Install identification on each duct system. Include arrows showing normal direction of flow.
 - a. painted stencils. Install on external duct insulation or exposed sheet metal.
 - b. Locate markers wherever ducts are exposed in finished spaces, machine rooms, accessible maintenance spaces and exposed exterior locations. Omit identification where ducts are exposed in finished spaces and intended to be architectural elements.
3. Piping or duct system identification and color of markers and stencils shall be per local codes, using agency standards, or ASHRAE Guide.

D. ACCESS AND PAINTING AND FINISHING

1. Install access panels and doors in accordance with manufacturers instructions. Edges and joints shall be finished. Provide field finish on access doors and panels to match surrounding surfaces.
2. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

E. ERECTION OF METAL SUPPORTS AND ANCHORAGE

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1 "Structural Welding Code--Steel."

F. ERECTION OF WOOD SUPPORTS AND ANCHORAGE

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
2. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.
3. Attach to substrates as required to support applied loads.

G. DEMOLITION

1. Disconnect, demolish, and remove work specified under Division 15 and as indicated. Demolition shall indicate removal of associated trim, fittings, insulation, supports and wiring.
2. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
3. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety. Cap take-off of demolished branch at main.
4. Abandoned Work: Cut and remove pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.
5. Removal: Remove indicated equipment from the Project site. Preserve and retain equipment indicated for delivery to Owner.
6. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

H. CUTTING AND PATCHING

1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of the trades involved.
2. Perform cutting, fitting, and patching of mechanical equipment and

materials required to:

- a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
3. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
 4. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 5. Repair cut surfaces to match adjacent surfaces. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 15050

SECTION 15100 - VALVES

PART I. - GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
2. Requirements of the following Division 15 Sections apply to this section:
 - a. "Basic Mechanical Requirements."
 - b. "Basic Mechanical Materials and Methods."
 - c. "Basic Piping Materials and Methods."

B. SUMMARY

1. This Section includes general duty valves common to most mechanical piping systems.
 - a. Special purpose valves are specified in individual piping system specifications.
2. Valve tags and charts are specified in Division 15 Section "MECHANICAL IDENTIFICATION."

C. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
2. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

D. QUALITY ASSURANCE

1. Single Source Responsibility: Comply with the requirements specified in Division 1 Section "MATERIALS AND EQUIPMENT," under "Source Limitations."
2. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
3. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

E. DELIVERY, STORAGE, AND HANDLING

1. Preparation For Transport: Prepare valves for shipping as follows:
 - a. Ensure valves are dry and internally protected against rust and corrosion.
 - b. Protect valve ends against damage to threads.

- c. Set valves in best position for handling.
- 2. Storage: Use the following precautions during storage:
 - a. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
 - b. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

PART II. - PRODUCTS

A. MANUFACTURERS

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, those listed in valve description and schedule.

B. VALVE FEATURES, GENERAL

- 1. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.
- 2. Sizes: Same size as upstream pipe, unless otherwise indicated.
- 3. Operators: Provide the following special operator features:
 - a. Handwheels, fastened to valve stem, for valves other than quarter turn.
 - b. Lever handles, on quarter-turn valves 6-inch and smaller.
- 4. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- 5. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- 6. End Connections: As indicated in the valve specifications.
 - a. Threads: Comply with ANSI B1.20.1.
 - b. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
 - c. Solder-Joint: Comply with ANSI B16.18. NOTE: Solder-Joint connections for valves in Heating piping is not permitted, valves will be threaded connections.
 - (1) Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

C. GATE VALVES

- 1. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Do not use

solder end valves for hot water heating.

2. Valve Type	Grinnell	Milwaukee	Nibco	Stockham
Bronze, class 150	3080/SJ	1151/1169	T134	B120/B124

D. BALL VALVES

1. Ball Valves, 1 Inch and Smaller: Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide solder ends for domestic hot and cold water service; threaded ends for heating hot water.

2. Ball Valves, 1-1/4-Inch to 2-Inch: Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide threaded ends for heating hot water.

3. Valve Type	Apollo	Grinnell	Milwaukee	Nibco
Ball, 2-piece, std.	70	3700/SJ	BA100/150	T/S580-70
Ball, 2-piece, full	77	3750/SJ	-	T/S585-70
Ball, 3-piece, full	82	3810/SJ	-	T/S595-Y

E. CHECK VALVES

1. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

2. Valve Type	Grinnell	Milwaukee	Nibco	Stockham
Bronze, class 150	3330/SJ	1/510T	T/S433-Y	-
Iron, class 125	6300A	F2974A	F918-B	G931

PART III. - EXECUTION

A. EXAMINATION

1. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

2. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

3. Examine threads on both the valve and the mating pipe for form

(i.e., out-of-round or local indentation) and cleanliness.

4. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
5. Replace defective valves with new valves.

B. VALVE ENDS SELECTION

1. Select valves with the following ends or types of pipe/tube connections:
 - a. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for heating hot water.
 - b. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.

C. VALVE INSTALLATIONS

1. General Application: Use gate or ball valves for shut-off duty; globe or ball for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.
2. Locate valves for easy access and provide separate support where necessary.
3. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
4. Install valves in horizontal piping with stem at or above the center of the pipe.
5. Install valves in a position to allow full stem movement.

D. SOLDER CONNECTIONS

1. Cut tube square and to exact lengths.
2. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.
3. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
4. Open gate and globe valves to full open position.
5. Remove the cap and disc holder of swing check valves having composition discs.
6. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.
7. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder

starts cooling, remove excess amounts around the joint with a cloth or brush.

E. THREADED CONNECTIONS

1. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
2. Align threads at point of assembly.
3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
4. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

F. FIELD QUALITY CONTROL

1. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

G. ADJUSTING AND CLEANING

1. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

H. VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

VALVES, 2-INCH AND SMALLER

<u>SERVICE</u>	<u>GATE</u>	<u>BALL</u>	<u>CHECK</u>
Domestic Hot and Cold Water	125	150	125
Heating Hot Water	150	150	150

END OF SECTION 15100

SECTION 15250 - MECHANICAL INSULATION

PART I. - GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes pipe, duct, and equipment insulation.
2. Related Sections: The following sections contain requirements that relate to this section:
 - a. Division 15 Section "Metal Ductwork" for duct lining.

C. DEFINITIONS

1. Hot Surfaces: Normal operating temperatures of 100 deg F or higher.
2. Dual-Temperature Surfaces: Normal operating temperatures that vary from hot to cold.
3. Cold Surfaces: Normal operating temperatures less than 75 deg F.
4. Thermal Resistivity: "r-values" represent the reciprocal of thermal conductivity (k-value). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between two exposed faces required to cause one Btu to flow through one square foot of material, in one hour, at a given mean temperature.
5. Density: Is expressed in lb/cu.ft.

D. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
2. Product data for each type of mechanical insulation identifying k-value, thickness, and accessories.

E. QUALITY ASSURANCE

1. Fire Performance Characteristics: Conform to the following characteristics for insulation including facings, cements, and adhesives, when tested according to ASTM E 84, by UL or other testing or inspecting organization acceptable to the authority having jurisdiction. Label insulation with appropriate markings of testing laboratory.
2. Interior Insulation: Flame spread rating of 25 or less and a smoke developed rating of 50 or less.
3. Exterior Insulation: Flame spread rating of 75 or less and a smoke

developed rating of 150 or less.

F. SEQUENCING AND SCHEDULING

1. Schedule insulation application after testing of piping and duct systems.

PART II - PRODUCTS

A. MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Glass Fiber:
 - i. CertainTeed Corporation.
 - ii. Knauf Fiberglass GmbH.
 - iii. Owens-Corning Fiberglas Corporation.
 - iv. Manville
 - b. Flexible Elastomeric Cellular:
 - i. Armacell, LLC.
 - ii. Halstead Industrial Products.
 - iii. IMCOA.
 - iv. Rubatex Corporation.

B. GLASS FIBER

1. Material: Inorganic glass fibers, bonded with a thermosetting resin.
2. Jacket: All-purpose, factory-applied, laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil having self-sealing lap.
3. Board: ASTM C 612, Class 2, semi-rigid jacketed board.
 - a. Thermal Conductivity: 0.26 average maximum, at 75 deg F mean temperature.
 - b. Density: 3 pcf average maximum.
4. Duct Blanket: ASTM C553, flexible duct wrap with foil skim kraft vapor barrier facing.
 - a. Thermal conductivity: 0.26 average at 750 F mean temperature.
 - b. Density: 0.75 average.
 - c. Greater densities may be used.
5. Preformed Pipe Insulation: ASTM C 547, Class 1, rigid pipe insulation, jacketed with double self sealing tape.
 - a. Thermal Conductivity: 0.26 average maximum at 75 deg F mean temperature.
 - b. Density: 6 average maximum.
6. Adhesive: Produced under the UL Classification and Follow-up service.
 - a. Type: Non-flammable, solvent-based.

b. Service Temperature Range: Minus 20 to 180 deg F.

C. JACKETS

1. General: ASTM C 921, Type 1, except as otherwise indicated.
 - a. Foil and Paper Jacket: Laminated glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
 - i. Water Vapor Permeance: 0.02 perm maximum, when tested according to ASTM E 96.
 - ii. Puncture Resistance: 50 beach units minimum, when tested according to ASTM D 781.

D. ACCESSORIES AND ATTACHMENTS

1. Glass Cloth and Tape: Woven glass fiber fabrics, plain weave, presized a minimum of 8 ounces per sq. yd.
 - a. Tape Width: 4 inches.
 - b. Cloth Standard: MIL-C-20079H, Type I.
 - c. Tape Standard: MIL-C-20079H, Type II.
 - d. Bands: 3/4-inch wide, in one of the following materials compatible with jacket:
 - i. Stainless Steel: Type 304, 0.020 inch thick.
2. Zeston 2000 PVC fitting covers and jackets

E. SEALING COMPOUNDS

1. Vapor Barrier Compound: Water-based, fire-resistive composition.
 - a. Water Vapor Permeance: 0.08 perm maximum.
 - b. Temperature Range: Minus 20 to 180 deg F.

F. FLEXIBLE ELASTOMERIC CELLULAR

1. Material: Closed cell, flexible elastomeric, ASTM C534, Type I and II- Grade 1, smoke/flame rating 25/50 ASTM E96, mold growth UL 181, fungi and bacterial resistance ASTM G21 G22, 0.2 percent volume water absorption ASTM C209, 0.08 perm-in. Water vapor permeability ASTM E96 procedure A, 0.28 thermal conductivity at 75° F mean temperature ASTM C518 or C177, excellent ozone resistance, density 3 to 6 pcf ASTM D1622.
2. Adhesive: Air drying contact adhesive, moisture resistant, flexible for temperature of 200° F.

G. RIGID CLOSED CELL FOAM BOARD

1. Material: Closed cell, rigid extruded polystyrene boards flat and tapered, ASTM C578, smoke/flame rating 165/5, 0.1 percent volume water absorption, 0.2 thermal conductivity at 75° F mean temperature, 25 psi compressive strength, 50 psi flexural strength; Dow Chemical Deckmate Plus or equal.
2. Adhesive: Water-based, air drying, contact adhesive, moisture resistant, flexible for temperature of 200° F, Foster Products Corporation 97-15 multipurpose adhesive. Adhesive shall be compatible with insulation.

PART III - EXECUTION

A. PREPARATION

1. Surface Preparation: Clean, dry, and remove foreign materials such as rust, scale, and dirt.
2. Follow cement manufacturer's printed instructions for mixing and portions.

B. INSTALLATION, GENERAL

1. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each mechanical system.
2. Select accessories compatible with materials suitable for the service. Select accessories that do not corrode, soften, or otherwise attack the insulation or jacket in either the wet or dry state.
3. Install vapor barriers on insulated pipes, ducts, and equipment having surface operating temperatures below 60 deg F.
4. Apply insulation material, accessories, and finishes according to the manufacturer's printed instructions.
5. Install insulation with smooth, straight, and even surfaces.
6. Seal joints and seams to maintain vapor barrier on insulation requiring a vapor barrier.
7. Seal penetrations for hangers, supports, anchors, and other projections in insulation requiring a vapor barrier.
8. Seal Ends: Except for flexible elastomeric insulation, taper ends at 45 degree angle and seal with lagging adhesive. Cut ends of flexible elastomeric cellular insulation square and seal with adhesive.
9. Apply adhesives and coatings at manufacturer's recommended coverage-per-gallon rate.
10. Keep insulation materials dry during application and finishing.

C. PIPE INSULATION INSTALLATION, GENERAL

1. Tightly butt longitudinal seams and end joints. Bond with adhesive.
2. Apply insulation with a minimum number of joints.
3. Apply insulation with integral jackets as follows:
 - a. Pull jacket tight and smooth.
 - b. Cover circumferential joints with butt strips, at least 3-inches wide, and of same material as insulation jacket. Secure with adhesive and seal vapor tight.
 - c. Longitudinal Seams: Overlap seams at least 1-1/2 inches. Apply insulation with longitudinal seams at bottom of pipe.

Clean and dry surface to receive self-sealing lap. Do not staple longitudinal laps on piping systems with surface temperatures at or below 55° F.

- d. Vapor Barrier Coatings: Where vapor barriers are indicated, apply on seams and joints, and at ends butt to flanges, unions, valves, and fittings.
 - e. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor barrier coating.
 - f. Repair damaged insulation jackets, except metal jackets, by applying jacket material around damaged jacket. Adhere, staple, and seal. Extend patch at least 2 inches in both directions beyond damaged insulation jacket and around the entire circumference of the pipe.
4. Roof Penetrations: Apply insulation for interior applications to a point even with the top of the roof flashing. Seal with vapor barrier coating. Apply insulation for exterior applications butted tightly to interior insulation ends. Extend metal jacket for exterior insulation outside roof flashing at least 2 inches below top of roof flashing. Seal metal jacket to roof flashing with vapor barrier coating.
 5. Interior Walls and Partitions Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions. Apply an aluminum jacket with factory-applied moisture barrier over insulation. Extend 2 inches from both surfaces of wall or partition. Secure aluminum jacket with metal bands at both ends. Seal ends of jacket with vapor barrier coating. Seal around penetration with joint sealer. Refer to Division 7 Section "Joint Sealants."
 6. Fire-Rated Walls and Partitions Penetrations: Terminate insulation at penetrations through fire-rated walls and partitions. Seal insulation ends with vapor barrier coating. Seal around penetration with firestopping or fire-resistant joint sealer.
 7. Hangers and Anchors: Apply insulation continuously through hangers and around anchor attachments. Install saddles, shields, and inserts to prevent compression of insulation and continuity of vapor barrier. For cold surface piping, extend insulation on anchor legs a minimum of 12 inches and taper and seal insulation ends.
 - a. Inserts and Shields: Cover hanger inserts and shields with jacket material matching adjacent pipe insulation.

D. FLEXIBLE ELASTOMERIC CELLULAR PIPE INSULATION INSTALLATION

1. Slip insulation on the pipe before making connections wherever possible. Seal joints with adhesive. Where the slip-on technique is not possible, cut one side longitudinally and apply to the pipe. Seal seams and joints with adhesive.
2. Valves, Fittings, and Flanges: Cut insulation segments from pipe or sheet insulation. Bond to valve, fitting, and flange and seal joints with adhesive.
 - a. Miter cut materials to cover soldered elbows and tees.
 - b. Fabricate sleeve fitting covers from flexible elastomeric cellular insulation for screwed valves, fittings, and

specialties. Miter cut materials. Overlap adjoining pipe insulation.

E. DUCT INSULATION

1. Install block and board insulation as follows:
 - a. Adhesive and Band Attachment: Secure block and board insulation tight and smooth with at least 50 percent coverage of adhesive. Install bands spaced 12 inches apart. Protect insulation under bands and at exterior corners with metal corner angles. Fill joints, seams, and chipped edges with vapor barrier compound.
 - b. Speed Washers Attachment: Secure insulation tight and smooth with speed washers and welded pins. Space anchor pins 18 inches apart each way and 3 inches from insulation joints. Apply vapor barrier coating compound to insulation in contact, open joints, breaks, punctures, and voids in insulation.
 - c. Insulation shall be applied using boards 1" thick, stagger joints minimum 6". For insulation outdoors, provide tapered insulation boards for top horizontal surface, tapered insulation shall be additional to nominal insulation thickness.
2. Install flexible duct blanket insulation as follows: Stretch insulation per manufacturer's instructions to prevent excessive compression. Apply mechanical fasteners on 18 inch centers on bottom of duct where dimension exceeds 24 inches. Seams shall be lapped and outward clinch stapled on 6 inch centers. Seal all joints, seams, tears, punctures, etc. with 3 inch pressure sensitive tape matching insulation jacket or with vapor barrier mastic reinforced with glass scrim tape.

F. JACKETS

1. Foil and Paper Jackets (FP): Install jackets drawn tight. Install lap or butt strips at joints with material same as jacket. Secure with adhesive. Install jackets with 1-1/2-inch laps at longitudinal joints and 3-inch-wide butt strips at end joints.
2. Seal openings, punctures, and breaks in vapor barrier jackets and exposed insulation with vapor barrier compound.
3. Field applied jacket for exterior ductwork shall be two coats of waterproof mastic with fiberglass mesh reinforcing between layers. Provide per insulation manufacturers requirements.

G. FINISHES

1. Paint finished insulation as specified in Division 9 Section "Painting."
2. Flexible Elastomeric Cellular Insulation: After adhesive has fully cured, apply 2 coats of protective coating to exposed insulation.

H. APPLICATIONS

1. General: Materials and thicknesses are specified in schedules at the end of this Section.

2. Interior Piping Systems: Unless otherwise indicated, insulate the following piping systems:
 - a. Domestic cold water, hot water, recirculated hot water.
 - b. Storm water. Insulate only roof drain bodies and horizontal rainwater leaders of storm water piping.
 - c. Refrigerant suction.
 - d. Hydronic piping, chilled and heating.
 - e. Steam and condensate steam.
 - f. Air conditioning condensate drain.

3. Duct Systems: Unless otherwise indicated, insulate the following duct systems:
 - a. Interior concealed supply, return and outside air ductwork.
 - b. Interior exposed supply, return and outside air ductwork.
 - c. Interior exposed and concealed supply fans, air handling unit casings and outside air plenums.

I. PIPE INSULATION SCHEDULES

1. General: Abbreviations used in the following schedules include:
 - a. Field-Applied Jackets: P - PVC, K - Foil and Paper, A - Aluminum, SS - Stainless Steel.
 - b. Pipe Sizes: NPS - Nominal Pipe Size.
 - c. Storm Water All Sizes (Interior): 1/2-inch-thick glass fiber, or flexible elastomeric insulation. Field-applied jacket is not required.

J. INTERIOR HYDRONIC (140 TO 200 DEG F) EXPOSED AND CONCEALED

<u>PIPE SIZES (NPS)</u>	<u>MATERIALS</u>	<u>THICKNESS IN INCHES</u>	<u>VAPOR BARRIER REQ'D</u>	<u>FIELD-APPLIED JACKET</u>
up to 1-1/4	GLASS FIBER	1-1/2	NO	NONE

K. DUCT SYSTEMS INSULATION SCHEDULE

INTERIOR CONCEALED HVAC SUPPLY AND RETURN DUCTS AND PLENUMS INSIDE BUILDING THERMAL ENVELOPE

<u>MATERIAL</u>	<u>FORM</u>	<u>INSTALLED R-VALUE</u>	<u>VAPOR BARRIER REQ'D</u>	<u>FIELD-APPLIED JACKET</u>
GLASS FIBER	BLANKET	6	YES	NONE

END OF SECTION 15250

SECTION 15510 - HYDRONIC PIPING AND ACCESSORIES

PART I. - GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
2. The following Division-15 Sections apply to this Section:
 - a. Basic Mechanical Requirements.
 - b. Basic Mechanical Materials and Methods.
 - c. General Duty Valves.
 - d. Supports and Anchors.

B. SUMMARY

1. This Section includes piping systems for hot water heating, and condensate drain piping. Piping materials and equipment specified in this Section include:
 - a. Pipes, fittings, and specialties;
 - b. Special duty valves;
 - c. Hydronic specialties.
2. Related Sections: The following sections contain requirements that relate to this Section:
 - a. Division 15 Section 15050 for materials and methods for sealing pipe penetrations through walls, and fire and smoke barriers.
 - b. Division 15 Section "General Duty Valves" for gate, ball, and check valves.
 - c. Division 15 Section "Mechanical Insulation" for pipe insulation.
 - d. Division 15 Section "Adjusting and Balancing" for procedures for hydronic systems adjusting and balancing.

C. DEFINITIONS

1. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

D. SYSTEM DESCRIPTION

1. General: The hydronic piping systems are the "water-side" of an air-and-water heating and air conditioning system. Hydronic piping systems specified in this Section include 2-pipe, hot water piping system. These systems are classified by ASHRAE as Low Water Temperature, Forced, Recirculating systems.

E. SUBMITTALS

1. Product Data, including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions for each hydronic specialty and special duty valve specified.

- a. Furnish flow and pressure drop curves for diverting fittings and calibrated plug valves, based on manufacturer's testing.
- 2. Maintenance Data for hydronic specialties and special duty valves, for inclusion in operating and maintenance manual specified in Division 1 and Division-15 Section "Basic Mechanical Requirements."
- 3. Certification of compliance with ASTM and ANSI manufacturing requirements for pipe, fittings, and specialties.
- 4. Reports specified in Part 3 of this Section.

F. QUALITY ASSURANCE

- 1. Regulatory Requirements: comply with the provisions of the following:
 - a. ASME B 31.9 "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 - b. 2012 International Mechanical Code.

PART II. - PRODUCTS

A. MANUFACTURERS

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering hydronic piping system products which may be incorporated in the work include, but are not limited to, the following:
 - a. Calibrated Balancing Valves:
 - (1) Bell & Gossett ITT; Fluid Handling Div.
 - (2) Taco, Inc.
 - b. Air Vents (manual and automatic):
 - (1) Armstrong Machine Works.
 - (2) Bell & Gossett ITT; Fluid Handling Div.
 - (3) Hoffman Specialty ITT; Fluid Handling Div.
 - (4) Spirax Sarco.
 - (5) Taco, Inc.
 - c. Dielectric Waterway Fittings:
 - (1) Victaulic Company of America
 - d. Dielectric Unions:
 - (1) Perfection Corp.
 - (2) Watts Regulator Co.
 - e. Y-Pattern Strainers:
 - (1) Armstrong Machine Works.
 - (2) Hoffman Specialty ITT; Fluid Handling Div.
 - (3) Metraflex Co.
 - (4) Spirax Sarco.

- (5) Trane Co.
- (6) Victaulic Co. of America.
- (7) Watts Regulator Co.

B. PIPE AND TUBING MATERIALS

1. General: Refer to Part 3 Article "PIPE APPLICATIONS" for identification of where the below materials are used.
2. Drawn Temper Copper Tubing: ASTM B 88, Type L.
3. Black Steel: ASTM A 53, Schedule 40, plain or grooved ends.

C. FITTINGS

1. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.
2. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
3. Unions: ANSI B16.39 malleable-iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends. Threads shall conform to ANSI B1.20.1.
4. Dielectric Unions: Threaded or soldered end connections for the pipe materials in which installed; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.

D. JOINING MATERIALS

1. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony, for heating hot water piping.

E. BALANCING VALVES

1. Calibrated Balancing Valves: 125 psi water working pressure, 250 deg F maximum operating temperature, bronze body, ball valve with calibrated orifice. Provide with connections for portable differential pressure meter with integral check valves and seals. Valve shall have integral pointer and calibrated scale to register degree of valve opening. Valves 2 inch and smaller shall have threaded connections.

F. HYDRONIC SPECIALTIES

1. Manual Air Vent: bronze body and nonferrous internal parts; 150 psi working pressure, 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; and having 1/8 inch discharge connection and 1/2 inch inlet connection.
2. Automatic Air Vents: High capacity float design, brass body and cover, rated for 150 psig working pressure; 240 deg. F maximum operating temperature; Bell & Gossett 400 series. High capacity air vents shall be cast iron body with stainless steel, brass and EPDM components, rated for 150 psig working pressure; 250 deg. F maximum operating temperature; Bell & Gossett Model 107A.
3. Y-Strainers: 125 psi working pressure; up to two inches: bronze

body, threaded ends, Watts Series 777; above 2 inches: cast-iron body (ASTM A 126, Class B), flanged ends, Watts Series 77F-D; perforated Type 304 stainless steel basket, and bottom drain connection.

4. Pressure gages shall be bronze Bourdon tube type, all brass construction movement, precision (+2 percent in mid range) gear and pinion, white dial mounted in brass bar stock socket independent of steel case. Pressure ranges shall be selected so that normal operating pressure is at gauge mid range. Dial shall be 3-1/2 inches in diameter. Ashcroft or approved equal. Provide 100 psig cock with hexagon shoulders for each pressure gage.
5. Thermometers shall be self-powered digital, variable angle read-out, 1 percent accuracy over -50 to 300 deg. F, with lifetime photocell/battery in heavy duty case. Stem shall be copper plated, precision ground steel with matched thermowell. Weiss Model DVU or approved equal. Stem and thermowell length shall be suitable for pipe size.

PART III. - EXECUTION

A. PIPE APPLICATIONS

1. Install Schedule Type L drawn copper tubing with wrought copper fittings and solder joints for 2 inch and smaller, above ground, within building.
2. Install Schedule 40 steel pipe with threaded joints and fittings for 2 inch and smaller.

B. PIPING INSTALLATIONS

1. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
2. Use fittings for all changes in direction and all branch connections.
3. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
4. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
5. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
6. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

7. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.
8. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
9. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.
10. Install piping at a uniform grade of 1 inch in 40 feet upward in the direction of flow.
11. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.
12. Install branch connections to mains using Tee fittings in main with take-off out the bottom of the main, except for up-feed risers which shall have take-off out the top of the main line.
13. Install unions in pipes 2 inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
14. Install dielectric unions to join dissimilar metals.
15. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated. Install nipple and ball valve in blow down connection of strainers 2 inch and larger.
16. Anchor piping to ensure proper direction of expansion and contraction. Expansion loops and joints are indicated on the Drawings.

C. HANGERS AND SUPPORTS

1. Install the following pipe attachments:
 - a. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
2. Install hangers with the following minimum rod sizes and maximum spacing:

<u>Nom. Pipe Size</u>	<u>Metal Pipe Max. Span-Ft.</u>	<u>PVC Pipe Max. Span-Ft.</u>	<u>Min. Rod Size-Inches</u>
1	7	3	3/8
1-1/2	9	4	3/8

3. Support vertical runs at each floor.

D. PIPE JOINT CONSTRUCTION

1. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."
2. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe fittings and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - b. Align threads at point of assembly.
 - c. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
 - d. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
 - (1) Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

E. VALVE APPLICATIONS

1. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
 - a. Shut-off duty: use gate and ball
 - b. Throttling duty: use ball
 - c. Install shut-off duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.
 - d. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, elsewhere as indicated.
2. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

F. HYDRONIC SPECIALTIES INSTALLATION

1. Install manual air vents at high points in the system, at heat transfer coils, and elsewhere as required for system air venting.

G. FIELD QUALITY CONTROL

1. Preparation for testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
 - a. Leave joints including welds uninsulated and exposed for examination during the test.
 - b. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 - c. Flush system with clean water. Clean strainers.
 - d. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve

2. Testing: Test hydronic piping as follows:
 - a. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
 - b. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of the that liquid.
 - c. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
 - d. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code For Pressure Piping, Building Services Piping.
 - e. After the hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

H. CLEANING, ADJUSTING AND CHEMICAL TREATMENT

1. Clean and flush mechanical piping systems. Isolate heat transfer coils prior to cleaning. Fill heating water system with detergent and dispersant and circulate system for 48 hours. Drain and flush until water runs clear. Remove, clean, and replace strainer screens. After cleaning and flushing, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.
2. Provide initial chemical treatment of the closed loop chilled water, heating water and boiler system to maintain the following conditions: pH 7.0 to 10.0 and molybdate 50 to 100 ppm.
3. Mark calibrated name plates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

I. COMMISSIONING

1. Fill system and perform initial chemical treatment.
2. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
3. Before operating the system perform these steps:
 - a. Open valves to full open position. Close coil bypass valves.
 - b. Remove and clean strainers.

- c. Check pump for proper direction of flow and correct wiring.
- d. Set automatic fill valves for required system pressure.
- e. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
- f. Set temperature controls so all coils are calling for full flow.
- g. Check operation of automatic bypass valves.
- h. Check and set operating temperatures of boiler to design requirements.
- i. Lubricate motors and bearings.

END OF SECTION 15510

SECTION 15870 - HVAC EQUIPMENT

PART I. - GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Requirements of the following Division 15 Sections apply to this section:
 - a. "Basic Mechanical Requirements."
 - b. "Basic Materials and Methods."

B. SUMMARY

1. This Section includes the following types of HVAC equipment:
 - a. Split system air conditioning units.
 - b. Packaged rooftop units.
 - c. Energy recovery ventilators.
 - d. Hydronic fan coil unit heaters.
2. Related Sections: The following sections contain requirements that relate to this section:
 - a. Division 15 Section "Sequence of Operations" for control sequence descriptions.
 - b. Division 15 Section "Testing, Adjusting, and Balancing" for air-handling systems testing, adjusting, and balancing requirements and procedures.
3. Products furnished but not installed under this Section include roof curbs for roof-mounted exhaust fans.

C. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
 - a. Product data for selected models, including specialties, accessories, and the following:
 - (1) Certified fan performance curves with system operating conditions indicated.
 - (2) Certified fan sound power ratings for air handling units.
 - (3) Motor ratings and electrical characteristics plus motor and fan accessories.
 - (4) Materials gages and finishes.
 - (5) Dampers, including housings, linkages, and operators.
 - (6) Heating and cooling capacities.
 - b. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
 - c. Wiring diagrams that detail power, signal, and control wiring.

Differentiate between manufacturer-installed wiring and field-installed wiring.

- d. Product certificates, signed by manufacturers of air-handling units, certifying that their products comply with specified requirements.
- e. Maintenance data for air-handling units, condensing units, and burners for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."

D. QUALITY ASSURANCE

1. Refrigeration and air conditioning units shall be AHRI rated.
2. UL Compliance: Fans and components shall be UL listed and labeled.
3. Nationally Recognized Testing Laboratory and NEMA Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
4. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
5. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

E. DELIVERY, STORAGE, AND HANDLING

1. Lift and support units with the manufacturer's designated lifting or supporting points.
2. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.
3. Deliver equipment as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

F. SEQUENCING AND SCHEDULING

1. Coordinate the installation of equipment supports, curbs, and building penetrations specified in Division 7.
2. Coordinate the size and location of structural steel support members.

G. EXTRA MATERIALS

1. Furnish one additional complete set of belts for each belt-driven fan.
2. Furnish one additional set of air filters for each piece of equipment with filters.

PART II. - PRODUCTS

A. PACKAGED ROOFTOP UNIT 6.5 TO 12.5 TONS

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. Johnson Controls
2. Provide packaged, rooftop heating and air conditioning units of size and capacity shown on drawings. All units shall be factory assembled, internally wired, fully charged with R-410a and 100 percent run tested to check cooling operation, fan and blower rotation and control sequence. Unit performance shall be rated in accordance with AHRI 210/240 or 360 and 270 testing procedures. Unit shall be UL tested with ANSI Z21.47 and listed, and ASHRAE 90.1 compliant. Unit shall be designed and manufactured in accordance with ISO 9001.
3. Unit casing shall be constructed of galvanized steel. Casing shall have non-corrosive, sloped drain pan, 1" thick fiberglass insulation with neoprene coating on air side. All components shall be mounted in a weather resistant steel cabinet with a primed and 1 mil coat baked acrylic painted exterior with hinged service doors. Provide standard size, four-inch throw away pleated filters, MERV-13.
4. Units shall have dual, direct-drive, hermetic reciprocating or scroll compressors with internal protection and independent refrigerant circuits. Motor shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage. Crankcase heater, internal temperature and current sensitive motor overloads shall be included for maximum protection. Compressors shall have internal vibration isolation and sound muffling to minimize vibration transmission and noise. External high pressure cutout and low pressure switches shall be provided.
5. Each refrigerant circuit shall have independent fixed orifice or thermal expansion valve, service pressure ports, sight glasses, and refrigerant line filter driers factory installed. An area shall be provided for replacement suction line driers. Condenser shall be micro-channel aluminum tubes and aluminum fins. The evaporator coil and condenser coil shall be leak tested to 150 psig and pressure tested to 450 psig at factory.
6. The outdoor fans shall be direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection. The indoor fan shall be belt drive, centrifugal, dynamically balance with long life sealed bearings and adjustable sheaves on slide out chassis. Blower motor shall have factory furnished variable frequency drive (VFD).
7. Air stream controls shall include integrated enthalpy economizer and variable air volume (VAV) controls. The economizer hardware assembly includes: fully modulating, low leak (2% at 1"), 0-100 percent, gear driven outdoor air and return air dampers, barometric relief damper, sensors for differential enthalpy adjustment. Compressor operation shall be permitted with economizer operation to maintain supply air temperature.
8. Unit shall be completely factory wired with necessary controls and

contractor pressure lugs or terminal block for power wiring. Units shall have factory installed unit powered GFI outlet and disconnect device, and internal, through unit wiring. Provide circuit board for interface with temperature control system and micro-processor controls for all 24 volt control functions. Provide anti-short cycle timing and time delay between compressors to provide machine protection.

9. Prefabricated metal roof curbs shall be by rooftop unit manufacturer, constructed using, minimum 14 gauge galvanized steel, ASTM A-446, 525 and 527, 3" integral base plates, internally reinforced with 1" X 1" X 1/8" steel angle. Curbs shall be completely insulated with 1" thick three (3) pound density fiberglass foil faced insulation. Provide factory installed pressure treated wood nailers and new sealing gaskets. Minimum height of curb shall be 14" above existing roof or as detailed on the drawings. Curbs shall be installed in strict accordance with manufacturers' printed instructions.

B. DUCTLESS, SPLIT SYSTEMS AIR CONDITIONING UNITS

1. Available Manufacturers: Subject to compliance with requirement, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
 - a. Carrier
 - b. Mitsubishi Electric
 - c. Sanyo
 - d. Trane
 - e. York
2. Testing Requirements: The following factory tests are required:
 - a. AHRI Standards 210/240.
 - b. ISO 9001 and Energy Star certification.
3. General: Provide split system, air cooled condensing units, and ductless fan coil units, that are by same manufacturer and rated as a matched set for indicated capacities and characteristics. Systems shall be cooling only, single evaporator for a single compressor, designed for low ambient cooling operation as scheduled. Provide ten (6) years warranty on condensing unit compressor and one (1) year warranty on all other parts.
4. Condensing Units: Inverter (variable frequency) driven compressor, R410a refrigerant, copper tube aluminum finned condenser, horizontal condenser discharge, low ambient controls for cooling operation down to 14 degrees Fahrenheit, refrigerant drier, cycle protector, single side service access.
5. Ductless fan coil unit: Copper tube, aluminum finned coil, fully insulated housing, finished painted, cleanable filter, multi-speed direct drive fan, condensate pan with drain connection, refrigerant control metering device. Unit shall be wall mounted or ceiling mounted as scheduled.
6. Provide: Wall mounted thermostat, ACR refrigerant tubing sets by unit manufacturer, suction line shall be insulated with 1/2" thick

closed cell flexible foam with UV protection, concrete pad support for condensing unit.

C. ENERGY RECOVERY VENTILATORS

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
 - a. Bryant
 - b. Carrier
 - c. RenewAire
 - d. Venmar
2. Testing Requirements: The following factory tests are required:
 - a. HVI Certified Ratings.
 - b. AHRI Certified Standard 1060.
 - c. ASHRAE Standard 84 for energy transfer ratings.
 - d. NFPA 90A & 90B compliant and UL 1812 listed.
3. General: Provide energy recovery ventilators that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics. Unit shall have 5 year warranty.
4. Housing: Housing and internal components shall be galvanized steel. All components shall be accessible through air tight, gasketed access panels. Case walls shall have 1" thick insulation.
5. Fans: Fans shall be direct drive, centrifugal blowers, statically and dynamically balanced. Motors shall be EISA premium efficient, permanently lubricated, thermally protected. Outdoor air and exhaust air streams shall be completely separated and have separate fans. Outdoor air and exhaust air streams shall have motorized dampers interlocked with their respective fans.
6. Energy recovery heat exchanger shall be lightweight polymer, cross flow, transferring sensible and latent energy without condensate or frosting (down to -10F and 40% relative humidity). Heat exchange core shall be protected with MERV 8 disposable filters on both air streams. Heat exchanger shall have 10 year warranty.

D. HYDRONIC UNIT HEATERS

1. Unit heaters shall have steel frame and formed steel plate housing. Hydronic coils shall be seamless copper tubes mechanically bonded to aluminum fins. Coils shall be tested to 375 psig and shall be suitable for hot water at 225 F or 325 psig.
2. Fans shall be direct drive propeller with factory balanced aluminum blades. Motors shall be totally enclosed with thermal overload protection, permanent split capacitor type with permanently lubricated ball bearings.
3. Unit heaters shall be horizontal, recessed for flush mounting in finished ceiling, integral return air and supply air grilles.

4. Manufacturer: Subject to compliance with requirements, provide coils of one of the following:
 - a. Carrier Corp.
 - b. Sterling Radiator
 - c. Trane Co.
 - d. York

PART III. - EXECUTION

A. EXAMINATION

1. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, equipment supports, and other conditions affecting performance of equipment.
2. Do not proceed until unsatisfactory conditions have been corrected.

B. INSTALLATION, GENERAL

1. Install equipment level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated.
2. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. FIELD QUALITY CONTROL

1. Manufacturer's Field Inspection: Arrange and pay for a factory-authorized service representative to perform the following:
 - a. Start up of rooftop units and their controls.

D. ADJUSTING, CLEANING, AND PROTECTING

1. Clean equipment to remove foreign material and construction dirt and dust. Vacuum clean fan wheels and cabinets.

E. COMMISSIONING

1. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
 - a. Remove shipping blocking and bracing.
 - b. Verify unit is secure on mountings and supporting devices and that connections for piping, ductwork, and electrical are complete. Verify proper thermal overload protection is installed in motors, starters, and disconnects.
 - c. Perform cleaning and adjusting specified in this Section.
 - d. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearings operations. Reconnect fan drive system, align belts, and install belt guards.
 - e. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.
 - f. Verify manual and automatic volume control and that fire and smoke dampers in connected ductwork systems are in the full-open position.

2. Starting procedures for fans:
 - a. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
 - b. Measure and record motor electrical values for voltage and amperage.
3. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for procedures for air-handling-system testing, adjusting, and balancing.

END OF SECTION 15870

SECTION 15891 - METAL DUCTWORK

PART I. - GENERAL

A. RELATED DOCUMENTS

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
2. Requirements of the following Division 15 Sections apply to this section:
 - a. "Basic Mechanical Requirements."
 - b. "Basic Mechanical Materials and Methods."

B. SUMMARY

1. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air conditioning systems in pressure classes from minus 2 inches to plus 10 inches water gage.
2. Related Sections: The following sections contain requirements that relate to this Section:
 - a. Division 15 Section "Mechanical Insulation" for exterior duct and plenum insulation.
 - b. Division 15 Section "Duct Accessories" for flexible duct materials, dampers, duct-mounted access panels and doors, and turning vanes.
 - c. Division 15 Section "Testing, Adjusting, and Balancing."

C. DEFINITIONS

1. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:
 - a. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
 - b. Joints: Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jams; duct, plenum, and casing abutments to building structures.

D. SYSTEM PERFORMANCE REQUIREMENTS

1. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original design results without increasing the system total pressure.

E. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
2. Product data including details of construction relative to materials, dimensions of individual components, profiles, and finishes for the following items:
 - a. Sealing Materials.
 - b. Fire-Stopping Materials.
 - c. Factory fabricated ducts and fittings.
3. Coordination drawings for ductwork installation in accordance with Division 15 Section "Basic Mechanical Requirements." In addition to the requirements specified in "Basic Mechanical Requirements" show the following:
 - a. Coordination with ceiling suspension members.
 - b. Spatial coordination with other systems installed in the same space with the duct systems.
 - c. Coordination of ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
 - d. Coordination with ceiling-mounted lighting fixtures and air outlets and inlets.
4. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 15 Section "Basic Mechanical Requirements" and Division 1.
5. Maintenance data for volume control devices, fire dampers, and smoke dampers, in accordance with Division 15 Section "Basic Mechanical Requirements" and Division 1.

F. QUALITY ASSURANCE

1. NFPA Compliance: Comply with the following NFPA Standards:
 - a. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems," except as indicated otherwise.
2. ANSI/SMACNA 006-2006 HVAC Duct Construction Standards.

G. DELIVERY, STORAGE, AND HANDLING

1. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
2. Store and handle sealant fire-stopping materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART II. - PRODUCTS

A. SHEET METAL MATERIALS

1. Sheet Metal, General: Provide sheet metal in manufacturers standard gage thicknesses indicated, ANSI Standard B32.2, and packaged and marked as specified in ASTM A 700.
2. Galvanized Sheet Steel: Lock-forming quality, ASTM A 653, Coating Designation G 90. Provide paint-grip mill phosphatizing finish, ASTM D2092, for exposed ducts.
3. Reinforcement Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts.
4. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

B. SEALING MATERIALS

1. Joint and Seam Sealants, General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics. Shelf life of sealant products shall be closely monitored. All sealants shall be used in accordance with the manufacturer's instructions. If product age is unknown, use products that are less than six months old.
2. Joint and Seam Tape: UL Standard 181, minimum two inches wide, glass-fiber-fabric reinforced. Tapes shall be compatible with substrate to which they are applied.
3. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with the tape to form a hard, durable, airtight seal.
4. Joint and Seam Sealant: One-part, non-sag, solvent based, polymerize sealant; formulated of rubber, hydrocarbon resins, and inert reinforcing with a minimum of 71 percent solids. UL classified with 15/25 flame spread/smoke developed. Sealant shall be rated for interior or exterior use and duct pressures up to 10" w.g. Sealant shall be applied within one year of manufacturing and shall be installed per manufacturer's instructions.
5. Flanged Joint Mastics: One-part, acid-curing, silicone elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

C. FIRE-STOPPING AND SMOKE RESISTING

1. Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.

2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
 - b. "Pensil 851"; General Electric Co.
 - c. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
 - d. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
 - e. "RTV 7403"; General Electric Co.
 - f. "Fyre Putty"; Standard Oil Engineered Materials Co.
3. Fire stop vertical grease duct to UL Standard 1479 for non-combustible construction. Provide grease duct manufacturer's firestop fittings and accessories.
4. Smoke resistive construction: Provide sheetmetal angles, of same gauge as ductwork, secured to smoke barrier and sealed to sheetmetal duct or compressed against duct insulation on all sides to make construction smoke resistant.

D. HANGERS AND SUPPORTS

1. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.
2. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
 - a. Hangers Installed In Corrosive Atmospheres: Electro-galvanized, all-thread rod or hot-dipped-galvanized rods with threads painted after installation.
 - b. Straps and Rod Sizes: Conform with Chapter 5 in SMACNA HVAC Duct Construction Standards, 2006 Edition, for sheet steel width and gage and steel rod diameters.
3. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
4. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
 - a. Where galvanized steel ducts are installed, provide hot-dipped-galvanized steel shapes and plates.
 - b. For stainless steel ducts, provide stainless steel support materials.
 - c. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.

E. RECTANGULAR DUCT FABRICATION

1. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel, in accordance with SMACNA "HVAC Duct Construction Standards," 2006 Edition, Tables in Chapter 2, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.
 - a. Fabricate rectangular ducts in lengths appropriate to

reinforcement and rigidity class required for pressure classification.

- b. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
2. Static Pressure Classifications: Except where otherwise indicated, construct duct systems to the following pressure classifications:
 - a. Supply Ducts: 3 inches water gage.
 - b. Return Ducts: 2 inches water gage, negative pressure.
 - c. Exhaust Ducts: 2 inches water gage, negative pressure.
 3. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gage or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," unless they are lined or are externally insulated.

F. RECTANGULAR DUCT FITTINGS

1. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," 2006 Edition, Figures 4-1 through 4-9. Elbows shall be of radius construction. Where space limitations prohibit the use of radius elbows, use 90 degree elbows with air foil style turning vanes.
2. Kitchen hood and shop hood exhaust duct fittings shall be 16 gauge steel with all joints and seams welded liquid tight. No turning vanes or other obstructions shall be in fittings or duct.

G. ROUND DUCT AND FITTINGS

1. Round ductwork shall be galvanized steel, longitudinal seam per SMACNA "HVAC Duct Construction Standards," 2006 Edition, Tables in Chapter 3, including their associated details Figures 3-4 through 3-7. Fittings shall be manufactured by duct manufacturer. Elbows shall not be mitered unless specifically noted as such.

PART III. - EXECUTION

A. DUCT INSTALLATION, GENERAL

1. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
2. Install ducts with the fewest possible joints.
3. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
4. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
5. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and

its equipment.

6. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
7. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.
8. Install insulated ducts with 1-inch clearance outside of insulation.
9. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
10. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
11. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and over electrical equipment spaces and enclosures.
12. Non-Fire-Rated Partition or Smoke Resistive Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 inches.

B. SEAM AND JOINT SEALING

1. General: Seal duct seams and joints as follows:
2. Pressure Classifications 3 Inches Water Gage and Greater: All transverse joints, longitudinal seams, and duct penetrations, SMACNA Seal Class A.
3. Pressure Classification 2 Inches Water Gage: All transverse joints and longitudinal seams, SMACNA Seal Class B.
4. Pressure Classification Less than 2 Inches Water Gage: Transverse joints only, SMACNA Seal Class C.
5. Seal externally insulated ducts prior to insulation installation.

C. HANGING AND SUPPORTING

1. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," 2006 Edition, Tables 5-1 through 5-3 and Figures 5-1 through 5-11.
2. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
3. Support vertical ducts at a maximum interval of 16 feet and at each floor.
4. Upper attachments to structures shall have an allowable load not

exceeding 1/4 of the failure (proof test) load but are not limited to the specific methods indicated.

5. Install concrete insert prior to placing concrete.
6. Install powder actuated concrete fasteners after concrete is placed and completely cured.

D. CONNECTIONS

1. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 15 Section "Duct Accessories."
2. Branch Connections: Comply with SMACNA "HVAC Duct Construction Standards," 2006 Edition, Figures 4-5 and 4-6.
3. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," 2006 Edition, Figures 7-6 and 7-7.
4. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," 2006 Edition, Figures 7-8 and 7-9.

E. FIELD QUALITY CONTROL

1. Remake leaking joints as required and apply sealants to eliminate noise due to leakage.

F. ADJUSTING AND CLEANING

1. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 15 Section "TESTING, ADJUSTING, AND BALANCING" for requirements and procedures for adjusting and balancing air systems.
2. Vacuum ducts systems prior to final acceptance to remove dust and debris.

END OF SECTION

SECTION 15910 - DUCT ACCESSORIES

PART I. - GENERAL

A. RELATED DOCUMENTS

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

B. SUMMARY

1. This Section includes the following:
 - a. Fire dampers.
 - b. Variable air volume boxes.
 - c. Turning vanes.
 - d. Duct-mounted access doors and panels.
 - e. Flexible connectors.
 - f. Flexible duct.
 - g. Acoustic duct lining.
2. Related Sections: The following Sections contain requirements that relate to this Section:
 - a. Division 15 Section "Direct Digital Controls" for electric damper actuators.
 - b. Division 16 Section "Fire Alarm Systems" for duct-mounted fire and smoke detectors.

C. SUBMITTALS

1. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
2. Product data including details for materials, dimensions of individual components, profiles, and finishes for the following items:
 - a. Fire dampers.
 - b. Variable air volume boxes.
 - c. Flexible duct.
 - d. Acoustic duct lining.

D. QUALITY ASSURANCE

1. NFPA Compliance: Comply with the following NFPA Standards:
 - a. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
 - b. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
2. ANSI/SMACNA 006-2006, HVAC Duct Construction Standards Metal and Flexible.

E. EXTRA MATERIALS

1. Furnish extra materials matching products installed as described

below, packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.

- a. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART II. - PRODUCTS

A. FIRE DAMPERS

1. General: Dynamic rated, UL labeled according to UL Standard 555 "Standard for Fire Dampers." Greenheck Model DFD Series, or approved equal. UL 555C for ceiling dampers.
2. Fire Rating: 1-1/2 or 3 hours, as required.
3. Frame: Type A or Type B; fabricated with roll-formed, 21-gage, galvanized-steel; with mitered and interlocking corners.
4. Mounting Sleeve: Factory-installed or field-installed galvanized steel.
 - a. Minimum Thickness: 0.056-inch (16-gage) or 0.138-inch (10-gage) thick as indicated, and length to suit application.
 - b. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of the wall or floor, and thickness of damper frame meets sleeve requirements.
5. Mounting Orientation: Vertical or horizontal as indicated.
6. Blades: Roll-formed, interlocking, 21-gage galvanized steel. In place of interlocking blades, provide full-length, 21-gage, galvanized-steel blade connectors.
7. Horizontal Dampers: Include a blade lock and stainless steel negator closure spring.
8. Fusible Link: Replaceable, 165 deg F, 212 deg F, or 286 deg F rated as indicated or required.

B. VARIABLE AIR VOLUME BOXES

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to, the following:
 - a. Johnson Controls.
2. Provide single duct, pressure independent variable air volume boxes of size and capacities shown on plans. VAV boxes shall be single duct variable volume, or approved equal. VAV boxes shall be AHRI Certified under Standard 880, ETL listed to meet UL1995, and sound performance shall be AHRI certified.
3. Single duct casing shall be minimum 22 gauge galvanized steel. Insulation shall be internal, 3/4" polymer foam, complying with UL 181, UL 723, ASTM E 84, and ASTM C 665. Damper shall be heavy gauge

steel with peripheral gasket. Air leakage shall not exceed 2% at 3" w.g. inlet static pressure. Shaft shall rotate in bronze oilite self-lubricating bearings and have permanent position indication. Damper shall prevent overstroking.

4. VAV box shall have center averaging multiport velocity sensors. VAV box shall be suitable for actuator and digital controls as furnished by ATC contractor for factory installation of controls on boxes by VAV box manufacturer.
5. Provide hydronic heating coils. Coils shall have ni-chrome elements, heavy gauge galvanized steel housing and control box, silicon controlled rectifier (SCR) for staging of heater, extended element life and reduced noise, factory installed on VAV box with connections for sheetmetal ductwork. Control cabinet shall have hinged access door with interlocking main disconnect and may be remote located from VAV box. Coil controls shall have air positive air flow switch, fan interlock, automatic reset thermal cut-out, secondary thermal cut-out, single point electrical connection for heater, fan and controls, and shall comply with the NEC.
6. Provide single or two row hydronic heating coil with copper tube and aluminum fins, factory installed on VAV box with connections for sheetmetal ductwork. Coils shall be ARI certified.

C. TURNING VANES

1. Fabricate turning vanes according to SMACNA HVAC Duct Construction Standards, 2006 Edition, Figures 4-3 through 4-4.
2. Manufactured Turning Vanes: Fabricate of 1-1/2-inch-wide, curved blades set at 3/4 inch on center, support with bars perpendicular to blades set at 2 inches on center, and set into side strips suitable for mounting in ducts.

D. DUCT-MOUNTED ACCESS DOORS AND PANELS

1. Frame: Galvanized sheet steel of gauge and construction methods for air tightness and to meet duct pressure class. Provide with bend-over tabs and foam gaskets.
2. Door: Double-wall, galvanized sheet metal construction with insulation fill and thickness, number of hinges and locks as indicated for duct pressure class. Provide vision panel where indicated. Provide 1-inch by 1-inch butt hinge or piano hinge and cam latches.
3. Seal around frame attachment to duct and door to frame with neoprene or foam rubber seals.
4. Insulation: 1-inch thick fiber glass or polystyrene foam board. Provide insulated access doors for all insulated ducts.

E. FLEXIBLE CONNECTORS

1. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL Standard 181, Class 1.

2. Standard Metal-Edged Connectors: Factory-fabricated with a strip of fabric 3-1/2 inches wide attached to 2 strips of 2-3/4-inch-wide, 24-gage, galvanized sheet steel or 0.032-gage aluminum sheets. Select metal compatible with connected duct system. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA HVAC Duct Standard, 1st Edition, Figure 2-19.
3. Conventional, Indoor System Flexible Connectors Fabric: Glass fabric double coated with polychloroprene.
 - a. Minimum Weight: 26 oz. per sq yd.
 - b. Tensile Strength: 480 lb per inch in the warp and 360 lb per inch in the filling.
4. Conventional, Outdoor System Flexible Connectors Fabric: Glass fabric double coated with Du Pont's HYPALON or other synthetic-rubber weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
 - a. Minimum Weight: 26 oz. per sq yd.
 - b. Tensile Strength: 530 lb per inch in the warp and 440 lb per inch in the filling.
 - c. High-Temperature System Flexible Connectors: Glass fabric coated with silicone rubber and having a minimum weight of 16 oz. per sq yd and tensile strength of 285 lb per inch in the warp, and 185 lb per inch in the filling.
 - d. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.
 - e. Minimum Weight: 14 oz. per sq yd.
 - f. Tensile Strength: 450 lb per inch in the warp and 340 lb per inch in the filling.

F. ACOUSTIC DUCT LINING

1. Material: Inorganic glass fibers bonded with thermosetting resin, ASTM C1070, with acrylic erosion resistant surface facing. Lining shall be Johns Manville Permacote or equal of Knauf, Certainteed, Owens Corning.
 - a. Thermal conductivity: 0.26 average at 75F.
 - b. Density: 1.5 pcf.
 - c. Duct velocities: 5000 fpm, per U.L. 181.
 - d. Flame spread/smoke developed: 25/50 per U.L. 723.
 - e. Noise reduction coefficient, 1" thickness: 0.65, ASTM C423.
2. Material: Closed cell, flexible elastomeric, ASTM C534, Type I and II- Grade 1, smoke/flame rating 25/50 ASTM E96, mold growth UL 181, fungi and bacterial resistance ASTM G21 G22, 0.2 percent volume water absorption ASTM C209, 0.08 perm-in. Water vapor permeability ASTM E96 procedure A, 0.28 thermal conductivity at 75° F mean temperature ASTM C518 or C177, excellent ozone resistance, density 3 to 6 pcf ASTM D1622. Lining shall be Nomaco K-Flex Gray Duct Liner, Armacell, LLC. Armacell SA Duct Liner, or equal of Halstead Industrial Products, IMCOA, Rubatex Corporation.
 - a. Adhesive: Air drying contact adhesive, moisture resistant, flexible for temperature of 200° F.
 - b. Duct velocities: 6000 fpm, per ASTM C1071.

c. Noise reduction coefficient, 1" thickness: 0.5, ASTM C423.

PART III. - EXECUTION

A. EXAMINATION

1. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of duct accessories. Do not proceed with installation until unsatisfactory conditions are corrected.

B. INSTALLATION

1. Install duct accessories according to manufacturer's installation instructions and applicable portions of details of construction as shown in SMACNA standards. Flexible duct installation and support shall be per SMACNA Standard Figures 3-10, 3-11, and 7-7.
2. Install duct sound lining in accordance with manufacturer's recommendations for air velocities of respective duct system. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner.
3. Provide test holes at fan inlet and outlet and elsewhere as indicated.
4. Install fire dampers according to the manufacturer's UL-approved printed instructions.
5. Install fusible links in fire dampers.
6. Label access doors according to Division 15 Section "Mechanical Identification."

C. ADJUSTING

1. Adjust duct accessories for proper settings.
2. Adjust fire dampers for proper action.
3. Final positioning of manual dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15910

SECTION 15971 - ELECTRONIC DDC CONTROL SYSTEMS

PART I. - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to work of this section.
2. Division-15 Basic Mechanical Materials and Methods sections apply to work of this section.

B. DESCRIPTION OF WORK:

1. Extent of control systems work required by this section is indicated on drawings and schedules, and by requirements of this section.
 - a. Furnish and install a complete Johnson Controls Metasys DDC (direct digital controls) with electric actuation. The system shall be an extension of the Johnson Controls Metasys system presently installed throughout the University campus.
 - b. Provide all required software, hardware, and programming for this project and the existing Metasys system.
2. Refer to other Division-15 sections for installation of instrument wells, valve bodies, and dampers in mechanical systems; not work of this section.
3. Provide the following electrical work as work of this section, complying with requirements of Division-16 sections:
 - a. Control wiring between field-installed controls, indicating devices, and unit control panels.
 - b. Line voltage power wiring from the existing Johnson Controls panels to proposed control panel location.

C. QUALITY ASSURANCE:

1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of electric control equipment, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
2. Installer's Qualifications: Firms specializing and experienced in electronic digital control system installations for not less than 5 years. Firms shall have in-place within fifty miles of the school district a support facility with necessary technical staff, spare parts inventory, test and diagnostic equipment.
3. Codes and Standards:
 - a. Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.
 - b. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
 - c. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems"

where applicable to controls and control sequences.

D. SUBMITTALS:

1. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.
2. Shop Drawings: Submit shop drawings for each electric control system, containing the following information:
 - a. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, and control devices.
 - b. Label each control device with setting or adjustable range of control.
 - c. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
 - d. Provide details of faces of control panels, including controls, instruments, and labeling.
 - e. Include verbal description of sequence of operation.
3. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

E. DELIVERY, STORAGE, AND HANDLING:

1. Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

F. GUARANTEE AND INSTRUCTION

1. The entire control system shall be free from defects in workmanship and materials under normal use and service for a period of one (1) year after acceptance by the Owner. After completion of the installation, this contractor shall regulate and adjust all thermostats, sensors, control valves, actuators, and other equipment provided under this contract. If, within two (2) years from the date of acceptance by the University any of the equipments herein described is proved to be defective, it will be replaced or repaired at no additional cost to the District. Normal maintenance of the system and its components is not to be considered part of the guarantee.
2. Upon completion of the work, the control system shop drawings shall be provided where. Six complete sets of as-built drawings shall be submitted to the Mechanical Contractor for his distribution. Drawings shall show all CCMS components and the function of each item.
3. Upon completion of the work, this contractor shall arrange to instruct the University's representative on the operation of the

system for not less than eight (8) hours. This instruction shall be on-site.

4. During the warranty period all Host Software upgrades released by Barber Colman Company shall be considered part of this contract and shall be installed at no cost to the District.

PART II. - PRODUCTS

A. ACCEPTABLE MANUFACTURERS:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electronic digital control systems which may be incorporated in the work include, but are not limited to, the following:
2. Manufacturer: Subject to compliance with requirements, provide electric control systems of one of the following:
 - a. Johnson Controls.

B. MATERIALS AND EQUIPMENT:

1. General: Provide control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, sensors, controllers, and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide control systems with following functional and construction features as indicated.
2. Control Valves: Provide factory-fabricated control valves of type, body material and pressure class indicated. Where type or body material is not indicated, provide selection as determined by manufacturer for installation requirements and pressure class, based on maximum pressure and temperature rating of piping system. Except as otherwise indicated, provide valves which mate and match material of connecting piping. Equip control valves with control valve motors, and with proper shutoff ratings for each individual application.
 - a. Water Service Valves: Equal percentage characteristics with rangeability of 50 to 1, and maximum full flow pressure drop of 5 psig.
 - b. Single-Seated Valves: Cage type trim, providing seating and guiding surfaces for plug on "top and bottom" guided plugs.
 - c. Double-Seated Valves: Balanced plug-type, with cage type trim providing seating and guiding surfaces for plugs on "top and bottom" guided plugs.
 - d. Valve Trim and Stems: Polished stainless steel.
 - e. Packing: Spring-loaded Teflon, self-adjusting.
 - f. Terminal Unit Control Valves: Provide control valves for control of terminal units including, but not necessarily limited to, convectors, finned tube radiation, and coils. Provide 2-position valves, electrically actuated by low voltage control wiring.
3. Unless otherwise noted, sensors located in conditioned spaces shall

have blank, locking covers. Finish shall be manufacturers standard, except where otherside noted on the drawings. All thermostat locations shall be submitted as required by the sequence of operation.

4. Differential and Static Pressure Sensors and Switches

- a. Fan proof-of-run switches shall be U.L. listed adjustable set point and differential pressure type. Switches shall be piped to fan discharge except where fans operate at less than one inch (1") WG, they shall be piped across the fan. for fractional horsepower and non-ducted fans, relays, current switches or auxiliary contacts may be used. Maximum pressure rating shall be at least 10 inches WG. with .05-12" W.C. range.

5. Miscellaneous Devices

- a. Freezestats shall be manually reset line voltage type with bellows actuated switches. Twenty four capillary shall be responsive to the coolest on foot section of its length.
- b. Aquastats shall be line voltage strap on type for single pole, single throw switching.

PART III. - EXECUTION

A. INSPECTION:

1. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. INSTALLATION OF CONTROL SYSTEMS:

1. General: Install systems and materials in accordance with manufacturer's instructions and roughing-in drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications. Mount controllers at convenient locations and heights.
2. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connecting electric control devices.
3. Wiring System: Install complete control wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Provide multi-conductor instrument harness (bundle) in place of single conductors where number of conductors can be run along common path. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
4. Number-code or color-code conductors, excluding those used for local individual room controls, appropriately for future identification

and servicing of control system.

5. Reset Limit Controls: Install manual-reset limit controls to be independent of power controllers; automatic duct heater resets may, at Contractor's option, be installed in interlock circuit of power controllers.
6. Unit-Mounted Equipment: Where control devices are indicated to be unit-mounted, ship electric relays, electric switches, valves, dampers, and damper motors to unit manufacturer for mounting and wiring at factory.

C. ADJUSTING AND CLEANING:

1. Start-Up: Start-up, test, and adjust electric control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
2. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
3. Final Adjustment: After completion of installation, adjust thermostats, control valves, motors and similar equipment provided as work of this section.
 - a. Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.

D. CLOSEOUT PROCEDURES:

1. Owner's Instructions: Provide services of manufacturer's technical representative for one 8-hour day to instruct Owner's personnel in operation and maintenance of electric control systems.

PART IV.- SEQUENCE OF OPERATION

A. Central Control and Monitoring System Software Description

1. General
 - a. The following programs shall be available to the control system:
 - (1) Optimum Start/Stop Control
 - (2) Outdoor Air Economizer
 - (3) Maintenance Time Reminder
 - (4) Time Program Command
 - (5) Total Run Time of Equipment
 - (6) Graphic Display
2. Sequence of Operation
 - a. Rooftop Units 1 and 2:

Winter Warm Up - Rooftop supply air fan is on and VAV boxes are full open. Space thermostats shall open and cycle control valve to heating coils at VAV boxes to maintain space temperature (70 F, adjustable).

Winter Occupied - Rooftop supply air fan is on. Unit supply air temperature sensor shall initiate economizer cycle to modulate outdoor air damper open and compressor cooling in stages to maintain supply air temperature (55 F, adjustable). Space temperature sensor shall cycle VAV box damper and control valve to coil to maintain space temperature between 70 F and 75 F (both adjustable). When space temperature calls for full heating, VAV box damper shall be wide open.

Winter Unoccupied - Unit fan shall be off and outdoor air damper closed and VAV boxes full open. Space temperature sensor shall cycle RTU fan and VAV box control valve to maintain set back temperature (55 F, adjustable).

Summer Occupied - Rooftop supply air fan is on. Unit supply air temperature sensor shall initiate economizer cycle to modulate outdoor air damper open and compressor cooling in stages to maintain supply air temperature (55 F, adjustable). Space temperature sensor shall cycle VAV box to maintain 75 F (adjustable).

Summer Unoccupied - Units shall be off and outdoor air damper closed.

b. ERV and Outdoor Air Ventilation:

- (1) ERV-1 shall be on and run continuously during occupied times and otherwise shall be off. ERV dampers shall be interlocked such that dampers are closed when unit blowers are off and open when unit blowers are on.

c. Ductless Split System Air Conditioner:

- (1) Space thermostat shall modulate and cycle unit compressor and indoor fan coil unit to maintain setpoint, 75 F (adjustable).

END OF SECTION 15971

SECTION 15990 - TESTING, ADJUSTING, AND BALANCING

PART I. - GENERAL

A. RELATED DOCUMENTS:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
2. Related Sections:
 - a. General requirements for testing agencies are specified in the Division-1 Section Quality Control Services.
 - b. Other Division-15 Sections specify balancing devices and their installation, and materials and installations of mechanical systems.
 - c. Individual Division-15 system sections specify leak testing requirements and procedures.

B. SUMMARY:

1. This Section specifies the requirements and procedures total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, witnessing duct leakage testing, and recording and reporting the results.
2. Test, adjust, and balance the following mechanical systems:
 - a. Supply air systems, all pressure ranges;
 - b. Return air systems;
 - c. Exhaust air systems;
 - d. Hydronic systems;
 - e. Verify temperature control system operation.
3. Test systems for proper sound and vibration levels.
4. This Section does not include:
 - a. specifications for materials for patching mechanical systems;
 - b. specifications for materials and installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing, refer to the respective system sections for materials and installation requirements.
 - c. requirements and procedures for piping and ductwork systems leakage tests.

C. DEFINITIONS:

1. Systems testing, adjusting, and balancing is the process of checking and adjusting all the building environmental systems to produce the design objectives. It includes:
 - a. the balance of air and water distribution;
 - b. adjustment of total system to provide design quantities;
 - c. electrical measurement;
 - d. verification of performance of all equipment and automatic

controls.

2. Test: To determine quantitative performance of equipment.
3. Adjust: To regulate the specified fluid flow rate and air patterns at the terminal equipment (e.g., reduce fan speed, throttling).
4. Balance: To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
5. Procedure: Standardized approach and execution of sequence of work operations to yield reproducible results.
6. Report forms: Test data sheets arranged for collecting test data in logical order for submission and review. These data should also form the permanent record to be used as the basis for required future testing, adjusting, and balancing.
7. Terminal: The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
8. Main: Duct or pipe containing the system's major or entire fluid flow.
9. Submain: Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
10. Branch main: Duct or pipe serving two or more terminals.
11. Branch: Duct or pipe serving a single terminal.

D. SUBMITTALS:

1. Agency Data:
 - a. Submit proof that the proposed testing, adjusting, and balancing agency meets the qualifications specified below.
2. Engineer and Technicians Data:
 - a. Submit proof that the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified below.
3. Procedures and Agenda: Submit a synopsis of the testing, adjusting, and balancing procedures and agenda proposed to be used for this project.
4. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 1 and Section 15010.
5. Certified Reports: Submit testing, adjusting, and balancing reports

bearing the seal and signature of the Test and Balance Engineer. The reports shall be certified proof that the systems have been tested, adjusted, and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed; are a true representation of how the systems are operating at the completion of the testing, adjusting, and balancing procedures; and are an accurate record of all final quantities measured, to establish normal operating values of the systems. Follow the procedures and format specified below:

- a. Draft reports: Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on the approved forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - b. Final Report: Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports.
 - c. Report Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
 - (1) General Information and Summary
 - (2) Air Systems
 - (3) Hydronic Systems
 - (4) Temperature Control Systems
 - (5) Special Systems
 - d. Report Contents: Provide the following minimum information, forms and data:
 - (1) General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentations used for the procedures along with the proof of calibration.
 - (2) The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC and NEBB, for each respective item and system. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.
6. Calibration Reports: Submit proof that all required instrumentation

has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.

E. QUALITY ASSURANCE:

1. Agency Qualifications:

- a. Employ the services of an independent testing, adjusting, and balancing agency meeting the qualifications specified below, to be the single source of responsibility to test, adjust, and balance the building mechanical systems identified above, to produce the design objectives. Services shall include checking installations for conformity to design, measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.
- b. An independent testing, adjusting, and balancing agency certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in the State in which the services are to be performed, certified by AABC as a Test and Balance Engineer.

2. Codes and Standards:

- a. NEBB: "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- b. AABC: "National Standards For Total System Balance".
- c. ASHRAE: 2003 Handbook - HVAC Applications, Chapter 37, Testing, Adjusting, and Balancing.

3. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and representatives of installers of the mechanical systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

F. PROJECT CONDITIONS:

1. Systems Operation: Systems shall be fully operational prior to beginning procedures.

G. SEQUENCING AND SCHEDULING:

1. Test, adjust, and balance the air systems before hydronic, steam, and refrigerant systems.
2. Test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 5 deg. F wet bulb temperature of maximum summer design condition, and within 10 deg. F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

PART II. - PRODUCTS (Not Used)

PART III. - EXECUTION

A. PRELIMINARY PROCEDURES FOR AIR SYSTEM BALANCING:

1. Before operating the system, perform these steps:
 - a. Obtain design drawings and specifications and become thoroughly acquainted with the design intent.
 - b. Obtain copies of approved shop drawings of all air handling equipment, outlets (supply, return, and exhaust) and temperature control diagrams.
 - c. Compare design to installed equipment and field installations.
 - d. Walk the system from the system air handling equipment to terminal units to determine variations of installation from design.
 - e. Check filters for cleanliness.
 - f. Check dampers (both volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
 - g. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a crosscheck with required fan volumes.
 - h. Determine best locations in main and branch ductwork for most accurate duct traverses.
 - i. Place outlet dampers in the full open position.
 - j. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
 - k. Lubricate all motors and bearings.
 - l. Check fan belt tension.
 - m. Check fan rotation.

B. PRELIMINARY PROCEDURES FOR HYDRONIC SYSTEM BALANCING:

1. Before operating the system perform these steps:
 - a. Open valves to full open position. Close coil bypass valves.
 - b. Remove and clean all strainers.
 - c. Examine hydronic systems and determine if water has been treated and cleaned.
 - d. Check pump rotation.
 - e. Clean and set automatic fill valves for required system pressure.
 - f. Check expansion tanks to determine that they are not air bound and that the system is completely full of water.
 - g. Check air vents at high points of systems and determine if all are installed and operating freely (automatic type) or to bleed air completely (manual type).
 - h. Set temperature controls so all coils are calling for full flow.
 - i. Check operation of automatic bypass valves.
 - j. Check and set operating temperatures of chillers to design requirements.
 - k. Lubricate all motors and bearings.

C. MEASUREMENTS:

1. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerances specified in the referenced standards.

Instruments shall be properly maintained and protected against damage.

2. Provide instruments meeting the specifications of the referenced standards.
3. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
4. Apply instrument as recommended by the manufacturer.
5. Use instruments with minimum scale and maximum subdivisions and with scale ranges proper for the value being measured.
6. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 10 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
7. Take all reading with the eye at the level of the indicated value to prevent parallax.
8. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
9. Take measurements in the system where best suited to the task.

D. PERFORMING TESTING, ADJUSTING, AND BALANCING:

1. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
2. Cut insulation, ductwork, and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
3. Patch insulation, ductwork, and housings, using materials identical to those removed.
4. Seal ducts and piping, and test for and repair leaks.
5. Seal insulation to re-establish integrity of the vapor barrier.
6. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
7. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.

E. TESTING FOR SOUND AND VIBRATION:

1. Test and adjust mechanical systems for sound and vibration in accordance with the detailed instructions of the referenced standards.

F. RECORD AND REPORT DATA:

1. Record all data obtained during testing, adjusting, and balancing in accordance with, and on the forms recommended by the referenced standards, and as approved on the sample report forms.
2. Record and report data of duct leakage testing performed by duct installing contractor.
3. Prepare report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

END OF SECTION 15990

DIVISION 16 - ELECTRICAL

SECTION 16000 GENERAL ELECTRICAL

PART I. - GENERAL

A. SUMMARY

1. The requirements of the General condition and Division I govern all work performed under the Division 16 - ELECTRICAL.
2. The requirements of this section of the specification apply to and form part of each electrical section of the specifications.

B. SCOPE

1. The work covered by this Section consists of furnishing all labor, equipment, supplies and materials and performing all operations including cutting, channeling and chasing necessary for the installation of the complete Electrical System as shown on the drawings, as hereinafter specified and as directed by the Architect.

C. GENERAL DESCRIPTION

1. The drawings indicate the general arrangement of the electrical work and service. The locations given for the outlets are approximate and shall be subject to minor modifications as directed by the Architect. The Contractor shall carefully examine all drawings and shall inspect the conditions of the site, and shall be responsible for the proper fitting of materials and equipment in the building without substantial alteration.
2. The work shall include, but not be limited to , the furnishings and installing of the following:
 - a. Complete wiring system, including branch circuits for lighting power, receptacles and special connections.
 - b. Empty raceway systems with outlets and pull ropes for telephone and data cable systems.
 - c. Testing, removal and disposal of PCB lighting ballasts per State and Federal Regulations.
 - d. Removal of existing electrical work.
 - e. Modifications and extension of existing electrical work.
 - f. Emergency and Exit Lighting.
 - g. Interior and exterior lighting fixtures, switches, receptacles, pull boxes, outlets, conduit, wiring, lamps., tubes, etc.
 - h. Equipment connections for heating, ventilating and air conditioning work, etc.
 - i. Complete grounding systems in accordance with the National Electrical Code.
3. Prior to start for electrical rough-in work all architectural, structural and detail drawings shall be consulted and outlets, conduit, etc., carefully installed in concrete, plaster, and other materials.
4. It is the requirements of this specification that proper service be provided to and for all pieces of equipment on the job requiring same. Contractor shall verify the service requirements of all

pieces of equipment before making final provisions. Contractor shall also check the exact point of connection for each piece of equipment so that service may be brought to the proper location. Particular emphasis shall be given to coordination of electrical outlets with casework, shelving, and desks.

D. CODES AND STANDARDS

1. All electrical work shall be in accordance with the rules and regulations of the County Departments having jurisdiction, and the National Electrical Code of the National Board of Fire Underwriters. The work shall be subject to inspections by the County Departments having jurisdiction. Upon completion, a certificate of compliance and acceptance shall be furnished to the Owner by the Contractor.
2. All costs in connection with these inspection and required permits shall be paid for by the Contractor.
3. All equipment shall be new and shall bear the U.L. label as approved.
4. Equipment shall be designed and tested in accordance with applicable requirements of ANSI, IEEE, NEMA, IES, ITL, UL, NEC and OSHA.
5. The entire service entrance installation shall be in accordance with the rules and regulations of the local utility company, who shall be consulted before starting the work. The Contractor shall pay all costs and fees pertaining to the Services and Metering installation. The Contractor shall also be responsible for providing temporary electric service and all costs and fees pertaining there to for the duration of the construction. Temporary electric power shall be provided in accordance with NEC Article 527.

E. DEFINITIONS

1. The following definitions apply to the terms and expressions used in this Division:
 - a. "Provide" - furnish and install completed.
 - b. "Directed" - directed by the Architect/Engineer.
 - c. "Indicated" - indicated in contract Documents.
 - d. "Concealed" - hidden from normal sight. This includes work in crawl spaces, above ceilings, in walls and shafts.
 - e. "Exposed" - not concealed.
 - f. "Review" - limited observation or checking to ascertain general conformance with design requirements and general compliance with contract document requirements. No part of this action constitute a waiver or change to the contract requirements.
 - g. "Owner" - Delaware State University

F. MATERIALS AND EQUIPMENT SCHEDULE

1. A complete schedule of materials and equipment proposed for installation shall be submitted to the Architect within thirty days after award of the contract. The schedule shall include catalogs, cuts, diagrams and such other descriptive data as may be required by the Architect. In the event any items of material or equipment contained the Schedule fail to comply with the specifications

requirements, such items shall be rejected. If prior to expiration of the thirty-day period or any duly authorized extension thereof, the contractor fails to submit a Schedule of acceptable materials of equipment covering the rejected items, the Owner reserves the right to select the item; and such selection shall be final and binding upon the Contractor as a condition of the Contract. All materials shall bear the Underwriters' Label.

2. In the event that equipment is contemplated for substitution in lieu of the specified equipment, the Contractor shall furnish a sample of the substituted equipment and a sample of the specified equipment along with supporting technical data for both, for evaluation by the Architect and Engineer.

G. CLEANING AND PAINTING

1. The Contractor under this Section, shall clean and remove all rust, scale, oil, grease, and dirt from all equipment and materials installed under this section. Equipment which is furnished with a final factory finish shall have painted finish touched up where finish is scratched or otherwise damaged. Touch-up shall be the same color and type as the original finish.

H. GUARANTEE

1. The material and workmanship of all parts of the electrical installation specified herein shall be guaranteed unconditionally for a period of one (1) year from the date of acceptance, against mechanical or electrical defects arising from faulty materials or workmanship. Either replacement or repairs shall be made promptly to any defective materials or workmanship without charge during that period.

I. AS-BUILT DRAWINGS

1. A separate set of clean, neat electrical prints shall be kept at the site at all times during the construction of the work for the express purpose of showing any and all changes made. The prints shall be marked daily showing any rerouting of feeders or branch circuits, grouping of conduits or circuits, additional pull or junction boxes, and/or change whatsoever. The prints shall be marked up in a neat, legible manner. At the completion and final acceptance of the project the complete set of "AS-BUILT" prints shall be delivered to the Architect.

J. MISCELLANEOUS STEEL SUPPORTS

1. All supports required to mount and support electrical equipment in all locations whether or not indicated on the drawings, shall be furnished and installed by the Contractor. This shall include miscellaneous steel shapes, channels, hangers, inserts, rods or any other type of mounting required to secure equipment.

K. TESTS

1. The Contractor shall under this Section of the specifications, test all 600 volt and below wiring and devices. Tests shall be made after all wiring is complete and ready for attachment of fixtures and equipment, and again when fixtures and equipment are installed.

Failure or defects in workmanship revealed by tests shall be corrected promptly and test reconducted.

2. All tests shall be performed by competent and experienced personnel of same submitted to the Owner prior to occupancy of the building. All tests must conform to ANSI/NETA MTS-2007 testing specifications for electrical power distribution equipment and systems.
3. Test shall include polarization of all outlets: proper motor rotation of all motors system ground resistance, panel phase load balancing and system power factor with all loads energized.

L. WORK IN EXISTING BUILDING

1. In areas indicated to be renovated, remove the entire electrical installation except those portions indicated to be reused. All unused conduit and wiring exposed after demolition shall be removed back to point of concealment. Unused wiring in concealed conduits shall be removed to source (nearest point of usage).
2. Where electrical systems pass through the renovated areas to serve other portions of the premises, they shall be suitably relocated and the systems restored to normal operation. any outages in systems shall be coordinated with the Owner. Where duration of proposed outages cannot be tolerated by the owner, provide temporary connection as required to maintain service.

M. SITE INSPECTION

1. The Contractor shall visit the project sites and shall verify all existing conditions prior to submitting his bid. No additions or changes will be authorized as a result of the Contractors failure to visit the sites and observe all existing conditions.

N. GROUNDING

1. The Contractor shall provide all labor, materials, equipment and services necessary for and reasonably incidental to, the furnishing and installation complete of the grounding as hereinafter specified.
2. Grounds and connections shall be provided in strict accordance with the latest provisions of the National Electrical Code as hereinafter specified.
3. The following shall be solidly grounded:
 - a. Conduit systems, complete.
 - b. Motor frames.
 - c. Equipment ground bus in panelboards.
 - d. Service Entrance Equipment.
4. Ground conductors shall be of copper sized as required by the National Electrical Code. Ground lugs and clamps shall be of the cast non-ferrous metal of the compression type.

O. DAMAGE TO OTHER WORK

1. The Contractor shall be held responsible for any damage to work already in place due to either his work or the negligence of his

workmen. Correction of all damaged work shall be done by the trades who originally installed the work at the expense of the Contractor under this Division.

P. OPERATING AND MAINTENANCE MANUAL

1. Furnish three copies of a manual containing a brief description of all electrical systems and their various components. In addition to the system descriptions, the manual shall contain full instructions for operation of the equipment and servicing requirements.
2. These manuals shall be submitted to the Architect prior to acceptance of the project by the Owner.

Q. IDENTIFICATION

1. All disconnect switches, breakers, safety switches, and manual starters shall be clearly identified with phenolic plates, attached by screws.
2. All wiring systems shall be identified with labels as follows:
 - a. Fire Alarm System Conductors - all terminations.
 - b. Emergency and Exit Lighting System - all terminations.
 - c. Conductors in junction boxes and pull boxes.
 - d. Conductors in outlet boxes used for common junction boxes.
 - e. Where terminal boxes are used, terminal screws shall be identified by marker strips. Labels and markers shall be as manufactured by Brady, their perma-code, wire marker series or approved equal.

R. MOUNTING HEIGHTS

1. The following mounting heights of the various electrical outlets and devices are for guidance only:
 - a. Switches - 4' - 0" to top.
 - b. Receptacles - 1" - 6" to centerline.
 - c. Fire Alarm Stations - 4" - 0" to top.
 - d. Fire Alarm Horn/Bell with strobe - 7' - 6".
 - e. Telephone and Data Outlets Wall - 1' - 6" to centerline.
 - f. Disconnecting Switches and Breakers - 5' - 6" to top of switch from floor.
2. In general, the mounting heights listed above are applicable where outlets are not in the proximity of architectural case work and shelving; however, field conditions may dictate changes. Where these special conditions occur, final mounting height shall be brought to the attention of the Architect, and a decision shall be given.
3. Particular attention shall be given to outlets in the proximity of architectural casework and tackboards to avoid conflicts.

S. FIELD INSTRUCTION

1. The following instruction times at each site (where applicable) for the listed systems shall be included as part of this project:

- a. Fire Alarm System - 3 hours
- b. Modified and/or upgraded electrical distribution systems - 2 hours.

T. PENETRATION OF WATERPROOF CONSTRUCTION

- 1. Coordinate the work to minimize penetration of waterproof construction. Where such penetrations are necessary, provide all necessary curbs, sleeves, shields, flashings, fittings and caulking to make the penetrations absolutely water tight.

END OF SECTION

SECTION 16120 RACEWAYS AND FITTINGS

PART I. - GENERAL

A. DESCRIPTION OF SYSTEM

1. Continuous from outlet to outlet unless indicated otherwise, complete with pulling and junction outlets, bushings, couplings and other fittings as required.

B. DEFINITION

1. Requirements established for the general term "conduit" are applicable to all cylindrical raceways including rigid conduit, IMC, EMT, nonmetallic, flexible, etc.

PART II. - PRODUCTS

A. CONDUIT

1. Threaded steel conduit shall be in accordance with UL 6 and ANSI C80.1. Conduit shall be zinc-coated on the outside and shall be either zinc-coated or with an approved corrosion-resistant coating on the inside. Where indicated on the drawings or required by code, threaded steel conduit shall be galvanized rigid steel (GRS); otherwise intermediate steel conduit (IMC), conforming to UL 1242 and ANSI c80.6, may be utilized.
2. Electrical metallic tubing (EMT) shall be in accordance with Fed. Spec. WW-C-563A, UL 797, and ANSI C80.3. EMT shall be zinc-coated on the outside and shall be either zinc-coated or coated with an approved corrosion-resistant coating on the inside.
3. Liquid-tight flexible metal conduit shall consist of a core of flexible galvanized steel tubing over which is extruded a liquid-tight jacket of polyvinyl chloride (PVC), UL listed and NEC Article 351-A. Suitable for hazardous locations Class I Div. 2, Class II Div. 1 & 2, Class III Div. 1 & 2. Liquid-tight flexible conduits not larger than 1-1/4 inch size shall be provided with a continuous copper bonding conductor wound spirally between the convolutions.
4. Flexible metal conduit (commercial Greenfield) shall be in accordance with Fed. Spec. WW-C-566C and UL 1.
5. Rigid non-metallic conduit shall be schedule 40 heavy wall PVC, U.L. listed rigid plastic conduit with fittings and solvent cement as recommended by manufacturer and in accordance with NEMA TC 3.
6. Liquid-tight, flexible, non-metallic conduit shall consist of fused PVC with crush and crimp resistant helical spring, UL listed and NEC Article 351-B.
7. Aluminum conduit shall not be used.

B. FITTINGS AND CONNECTORS

1. Fittings for threaded steel and thin wall (EMT type) conduit shall be in accordance with Fed. Spec. W-F408D, except that the material shall be steel.

2. Compression type threadless fittings shall not be used with threaded steel conduit. Where it is impractical (due to limited working space when employing normal installation practices) to use common construction tools for the installation of threaded steel conduit with standard couplings, lock-nuts and bushings, steel set screw connectors and couplings shall have a wall thickness at least equal to the wall thickness of the conduit with which it is to be used. The set screws shall be of case hardened steel with hex head, and with cup point to firmly seat in wall of conduit for positive ground. The set screws shall be tightened to embed in conduit wall. Tightening screws with pliers will not be permitted. Set screw requirements shall be the following:
 - a. 1/2 through 2 inch connectors shall have one set screw each.
 - b. 2-1/2 through 4 inch connectors shall have two set screws each.
 - c. 1/2 through 2 inch couplings shall have two set screws each.
 - d. 2-1/2 through 4 inch couplings shall have four set screws each.
3. Couplings and connectors for EMT shall be made of either steel, or malleable iron. They shall be "Concretetight" or "Raintight" and shall be of either the gland and ring compression type, set screw type, or the stainless steel multiple locking type. All connectors shall have insulated throats. Fittings using indentation as a means of attachment shall not be used.
4. Bushing for threaded steel conduit and connectors for EMT shall be of the insulated type, designed to prevent abrasion of wires without impairing the continuity of the conduit grounding system. The insulating insert shall be made of thermosetting or fiber material which conforms to the flame test requirements of UL 514, molded or locked into the metallic body of the fittings. Conduit bushings made entirely of nonmetallic material shall not be used.
5. Fittings for liquid-tight flexible conduit shall be in accordance with Fed. Spec. W-F-406D of a type incorporating a threaded grounding cone, a steel, nylon or equal plastic compression ring, and a gland for tightening. Fittings shall be made of steel or malleable iron. They shall have insulated throats and shall be of a type having a male thread and locknut or male bushing with or without "O" ring seal.
6. Fittings for flexible metal conduit shall be in accordance with Fed. Spec. W-F-406D. Fittings shall be made of steel or malleable iron. They shall be insulated and shall be of one of the following types:
 - a. Wedge and screw type having an angular wedge fitting between the convolutions of the conduit.
 - b. Squeeze or clamp type having a bearing surface contoured to wrap around the conduit and clamped by one or more screws.
 - c. Steel, multiple point type, for threading into internal wall of the conduit convolutions.
7. Fittings made inferior material, such as "pot metal", shall not be used on any type of rigid or flexible conduit or EMT.

C. WIREWAYS AND GUTTERS

1. Constructed of galvanized steel with wire retaining spring clips for wireways with bottom or side access.
2. Wireway Covers: Screw type.
3. Provide wire retaining snap-in spring clips.

D. EXPANSION - CONTRACTION CONDUIT FITTINGS

1. Type "FSK": Cast-in-place seal with pressure rings and sealing grommet.
2. Individual pipe hangers, multiple (Trapeze) pipe hangers, and riser clamps shall be provided as necessary to support conduits, and all parts and hardware necessary for hanger assembly, and for securing hanger rods and conduits shall be provided. Each multiple hanger shall be designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds.

PART III. - EXECUTION

A. GENERAL

1. Size all raceway as required by the National Electrical Code with oversize conduits as indicated. Minimum branch circuit home run conduit size: 3/4 inch. Minimum conduit size 1/2 inch unless indicated otherwise.

B. RACEWAY ROUTING

1. As required by job conditions. Verify exact locations of all raceways, pull boxes, and junction boxes; resolve any conflicts before installation. Give priority in available space to large waste lines, drain lines, large air ducts, and all structural steel. Install split coupling type fittings only in areas where conduit is routed exposed or when conduit is installed in concrete.

C. MINIMUM SPACING

1. Three inches between raceways and water or waste piping, and six inches between raceways and steam or condensate lines.

D. RACEWAY CONCEALED

1. Conceal all raceways in all finished areas. When raceways are installed above lay-in type ceilings, do not interfere with the "Lift-Out" feature of the ceiling system. Route raceway exposed in electrical room and open stage and equipment areas. Install exposed raceway parallel or perpendicular to walls, ceilings, or structural members. All bends in exposed raceways shall be at right angles.

E. RACEWAY SUPPORT

1. Rigidly support from building structure all raceway and conduits

using pipe hangers, trapeze supports, clamps or straps. Conduits smaller than 1" trade size installed above suspended ceilings may be rigidly supported from duct work supports or ceiling supporting wires using approved conduit clips. Rigidly anchor vertical conduits serving equipment mounted away from walls with metal bracket or conduit extension secured to floor.

2. Perforated straps or tie wires are not acceptable for conduit installations; use rigid straps.
3. Do not penetrate mechanical duct work or anchor into mechanical duct work for electrical materials unless specifically indicated or approved. Route raceways in mechanical chases and tunnels, supported from Division 15 brackets only if specifically indicated or approved.
4. All EMT and conduits not embedded in concrete or masonry shall be securely and independently supported so that no strain will be transmitted to outlet box and pull box supports. Supports shall be rigid enough to prevent distortion of conduits during wire pulling.
5. Individual horizontal conduits and EMT shall be supported by one-hole pipe straps or separate pipe hangers for sizes 1-1/2 inch and smaller, and by separate pipe hangers for larger sizes. Spring steel fasteners may be used in lieu of pipe straps or hangers for sizes 1-1/2 inch and smaller in dry locations only. Hanger rods used with spring steel fasteners shall be not less than 1/4 inch diameter steel with corrosion resistant finish. Spring steel fasteners shall be specifically designed for supporting single conduits or EMT. Type, size and spacing of spring steel fasteners together with accessories shall be as approved by the Engineer and the Contractor shall submit all applicable load and rating data for approval. Unless otherwise specified, wire shall not be used as a means of support.

F. EXPANSION-CONTRACTION FITTINGS

1. Installed at each building expansion joint. Provided grounding continuity at each expansion-contraction fitting.
2. Every conduit system shall be installed complete before any conductors are drawn in. Each run of conduit shall be blown through before conductors are installed.
3. Where conduits are buried in concrete, they shall cross the building expansion joints at right angles, and the expansion fittings shall be installed in accordance with the manufacturer's instructions. Free ends of conduits shall be provided with insulated bushings.

G. CONDUIT SEALS

1. Provide Type "FSK" cast-in-place where conduit passes through exterior walls from 1 to 60 inches below finished grade. Install seals as recommended by the manufacturer to achieve a sealed watertight installation.

H. CONDENSATION SEALS

1. Install where conduits pass through barriers separating areas having a possible temperature differential of 30 degrees F, and in conduits entering air handling units. Install pliable removable plastic compound at the nearest box at the top end of vertical runs and at the cold end of horizontal runs.
- I. ELECTRIC METALLIC TUBING
1. Allowed unless otherwise indicated.
- J. RIGID STEEL OR IMC
1. Provided in outside walls, exposed exterior locations, and all panelboard feeders.
- K. FLEXIBLE METAL CONDUIT
1. Provided to dampen the effect of rotating or vibrating equipment (motors, transformers) on the remainder of the conduit system, and to allow repositioning of equipment requiring realignment. Flexible metal conduit from 2 to 6 feet long may be used for final connections to lighting fixtures. Flexible metal conduit may be used within steel stud walls and to connect the non-flexible raceway leaving the wall. Use only flexible metal conduit and fittings approved for the purpose of grounding. Flexible metal conduit shall be provided with grounding wire.
- L. LIQUID-TIGHT FLEXIBLE CONDUIT
1. Provide flexible metal when conduit is required in damp or wet locations or outdoors. Provide flexible non-metallic conduit where branch circuits are concealed in masonry or direct buried. Make all fittings and couplings watertight.
- M. RIGID NON-METALLIC CONDUIT
1. Make all joints and connections using fittings designed for the purpose of bonded permanently and watertight using solvent cement. Comply with the manufacturer's recommendations for bending and cutting. When conduits are stubbed out for future use or for use by others, cap conduits with end caps designed for the purpose by the conduit manufacturer.
- N. PULL BOXES AND MISCELLANEOUS FITTINGS
1. Install all pull boxes and fitting used for pulling so they are accessible when construction is complete. Do not place pull boxes and fittings in finished areas without specific permission. Do not use conduit bodies when conductors are No. 2 AWG or larger unless indicated otherwise or unless specifically approved.
- O. HEATING EQUIPMENT
1. Mount raceways away from heated portions of this equipment.

END OF SECTION

SECTION 16122 - BOXES AND FITTINGS

PART I.- GENERAL

A. WORK INSTALLED BUT FURNISHED BY OTHERS

1. Provide fittings as required for boxes furnished with equipment provided by others.

PART II. - PRODUCTS

A. BOXES AND FITTINGS

1. Non-gangable, galvanized steel with galvanized steel covers. Acceptable Manufacturers: Appleton; Raco; Steel City. Sectional switch boxes and die-cast boxes are not approved and shall not be used.
2. Floor boxes: standard stamped steel for concrete floors, minimum 2.9" deep, adjustable before and after poured floor, with round brass cover and duple outlet flaps.

B. PULL BOXES

1. Pull boxes shall conform to the applicable requirements of the NEC and boxes over 100 cubic inches in volume shall also conform to UL 50. Sheet metal boxes shall be adequately formed or structural steel bracing welded into a rigid assembly shall be provided to maintain alignment in shipment and installation. Covers shall be secured by corrosion-resistant screws or bolts.
2. Pull boxes exposed to rain or installed in wet locations shall be of the weatherproof type.

PART III.- EXECUTION

A. INSTALLATION

1. Install all outlet boxes snugly, rigidly, plumb, and level. Secure outlet boxes to ceiling system support members and wires using only clips approved for the purpose. Do not cut insulation in outside walls to install outlet boxes. Do not use through-the-wall boxes or back to back mounting arrangements. Protect boxes during construction to prevent entrance of foreign materials such as concrete, mortar, plaster, paint, etc.
2. Size all boxes so they are completely covered by the wall plate or fixture.
3. Provide FS and FD boxes and required covers surface mounted in damp or wet locations.

B. PULL BOXES

1. Pull boxes connected to concealed conduits shall be mounted with the covers flush with the finished wall or ceiling.
2. Conduits for telephone, data and other systems for which no wire is specified herein, shall be provided with pull boxes at least 50 percent larger than would be required by Article 370 of the NEC. Boxes shall be strategically located and of such shapes as to permit easy pulling of future wires or cables of types normally used in such systems. The number and locations of boxes shall be such that not more than 70 feet of conduit and the equivalent of two 90-degree bends will occur between boxes.

END OF SECTION

SECTION 16130 - CONDUCTORS (WIRE & CABLE)

PART I. - GENERAL

A. DEFINITIONS

1. "Branch Circuit" - all circuit conductors between the final overcurrent device and the utilization equipment.
2. "Feeder" - all circuit conductors between service distribution equipment and the origin of branch circuits.

B. SUBMITTALS

1. Submit catalog cuts and Product Data (PD) completely describing medium voltage cables.
2. Submit manufacturer's Product Data (PD) describing medium voltage termination and splicing systems.
3. Submit evidence of listing by U.L.

PART II. - PRODUCTS

A. CONDUCTORS, 600 VOLT CLASS

1. No. 12 AWG copper complying to Fed. Spec. J-C-30A, unless approved and listed. For specific purposes or specific environments, use conductor insulations specifically listed for those locations.
2. Provide conductor insulation systems that are U.L. approved and listed. For specific purposes or specific environments, use conductor insulations specifically listed for those locations.
3. No. 12 and No. 10 AWG:
 - a. Solid annealed or stranded copper conductors with Type THHN, THWN, or XHHW insulation.
4. No. 8 AWG and Larger:
 - a. Stranded, copper conductors with Type THHN, THWN, or XHHW insulation.
5. Lugs and Splices, Stranded Conductors:
 - a. Crimp on connectors, set screw box lugs, all lugs, sufficiently large enough to encompass all strands of the attached conductor(s).

B. SPLICES AND TERMINATIONS, 600 VOLT CLASS

1. Make all joints in branch-circuit wiring mechanically and electrically secure with solderless connectors as listed by Underwriters Laboratories Inc., (UL) as pressure cable type, 600-volt rating, compression or indent type.
 - a. Insulate all joints or terminations by approved type integral or separate cover, or by means of taping with approved plastic or rubber and friction tapes to provide insulating value equal to that of the conductors being joined.
 - b. The number and size and combination of conductors permitted by the Underwriters Laboratories Inc., as listed on manufacturers's packaging of connector shall be strictly complied with. Splice connectors shall be of a type and be so

installed that the conductor is positioned in its final operation position.

- c. Connectors for splicing No. 14 AWG and smaller stranded or No. 18 AWG and smaller solid conductors shall be crimp or pressure indent type. Exception to the above is the connection of lighting fixtures to the branch circuit supply conductors, which may be by screw-on type pressure connectors or any of the other methods herein specified.
 - d. Temperature rating of connectors shall be at least equal to that of the wire on which they are used.
2. Terminations or splices for stranded conductors No. 6 and larger shall utilize indent, hex screw, or bolt clamp-type connectors, with or without tongue, as approved by the Engineer for the particular application. Connectors which are not factory furnished with equipment, for cable sizes 250 MCM and larger, shall have not less than two clamping elements or compression indents. Terminals for bus connections, with cable sizes 250 MCM and larger, shall have at least two bolt holes unless anti-turning means is provided. All wire and cable connectors shall be of high conductivity corrosion-resistant material, and have ampere capacity which must at least equal the current carrying capacity of the wire or cable. Feeder and branch circuit solderless connections must also conform to Fed. Spec. W-S-610C.
 3. Plastic electrical insulating tape for use in lieu of rubber and friction tape shall be as specified below for various conditions.
 - a. For general inside use, the plastic tape shall conform to Fed. Spec. HH-I-595C and shall be flame retardant.
 - b. For general outdoor use, the plastic tape shall conform to Fed. Spec. HH-I-595C and shall be cold and weather resistant.
 4. Rubber electrical; insulating tape shall be noncorrosive to copper, self-fusing and have a minimum of 350 volts per mil dielectric strength and shall further meet the requirements of Fed. Spec. HH-I-553B.
 5. All terminals and connectors shall be wrench torqued at least to the minimum values listed in Underwriters Laboratories Standard UL 486.

C. CABLE

1. Metal-Clad (MC) Cable: Solid copper, No. 10 and larger, or stranded copper, No. 8; conforming to ASTM B3 or B8, UL 83, 1083 and 1569, and listed to UL 1, 2, and 3 hour through-penetration fire wall rating; THHN/THWN insulated multi conductor with green insulated ground conductor. Cable shall be suitable for dry locations and maximum conductor temperature of 90C. Cables shall be protected by a flexible interlocking aluminum armor.

PART III. - EXECUTION

A. INSPECTION

1. Examine all wire and cable prior to installation. Do not use wire and cable with bruised, cut, or abraded insulation; or wire that does not pass a continuity test.

B. INSTALLATION

1. Install all conductors and other associated items in raceways compliance with manufacturer's recommendations. Furnish and install

terminations, including lugs if necessary to make electrical connections indicated. Make connections and terminations for all stranded AWG conductors using crimp, clamp, or box type connectors and terminators. Enclose all strands of stranded conductors in connectors and lugs.

2. Conductors shall be sized for 75 deg. C rated insulations. Do not substitute smaller conductors with higher temperature rated insulations in lieu of conductor size required for 75 deg. C insulation or when shown larger on Drawings.
3. Do not use aluminum, copper-clad aluminum, or aluminum alloy.
4. Color Code, Branch Circuit and Feeder Wiring:

120/208 Volts

<u>Phase</u>	<u>Color</u>
A	Black
B	Red
C	Blue
Neutral	White
Ground	Green

5. Conductors No. 10 AWG and Smaller: Color impregnated.
6. Conductors No. 8 and larger may use color impregnated insulation or conductor ends may be taped. Taping: Solid color electrical tape, lap wound, visible without removing dead-front covers in electrical equipment, with at least three inches visible at all terminations and electrical boxes.
7. Arrangement of phases in all electrical equipment:

A, B, C Front to Rear.
A, B, C Top to Bottom.
A, B, C Left to Right When Facing Established Front of Equipment.
8. Provide conductors with not less than 90 degrees C rated insulation when branch circuit wiring is attached to high temperature light fixtures (e.g. fluorescent), and other heat producing equipment.

C. CONNECTORS

1. All electrical connections and terminations, such as on panelboards, circuit breakers, switches, and motor starters, and splitbolt connectors, shall be drawn up tight to torque values prescribed, values listed in applicable UL Standards and NEMA publications shall be used. Taps in conductors No.6 and larger shall be made with compression taps.
2. Splicing shall be done in junction boxes or outlet boxes, not in raceways. Splices in conductors No. 10 and smaller shall be with wire connectors. Splices in conductors No. 8 and larger shall be with compression connectors or solderless connectors.

D. MC CABLE INSTALLATION

1. MC cable shall be installed in compliance with NEC and shall be suitable for occupancies and locations where used. MC cable may be installed in drywall partitions and above ceilings, and shall not be installed in masonry walls. Use connectors and accessories as specified and in compliance with manufacturers requirements and NEC. MC cable larger than No. 8 shall no be used.

E. WIRE AND CABLE INSTALLATION SCHEDULE

1. Branch circuits concealed in interior locations, above ceilings and in walls: Building wire in raceways or MC cable.
2. HVAC Equipment: Building wire in raceways, or MC cable inside building and building wire in flexible sealtite conduit.

END OF SECTION

SECTION 16132 - SAFETY SWITCHES

PART 1 - GENERAL

1.01 SUBMITTALS

- A. Product Data (PD) manufacturer's brochures, and Operating and Maintenance Manual (OMM).

1.02 STANDARDS

- A. Federal Specification W-S-865C.

PART 2 - PRODUCTS

2.01 SAFETY SWITCHES

- A. NEMA Heavy Duty, fully enclosed, with defeatable full cover interlocks, quick-make/quick-break switching mechanisms, indicating handles that accept a minimum of three padlocks, and dual horsepower rating. Switch shall be capable of interrupting and locked rotor current of the motor for which it is to be used, which will be assumed as ten (10) times the full rated load current.
- B. Provide NEMA 3R enclosures in exterior or damp locations. All other areas shall be NEMA 1 enclosed.
- C. All parts shall be mounted on insulating bases to permit replacement of any part from the front of the switch. All current-carrying parts shall be of high-conductivity copper, designed to carry rated load without excessive heating. Switch contacts shall be silver-tungsten type or plated to prevent corrosion, pitting and oxidation and to assure suitable conductivity. Fuse clips shall be of the positive pressure type and the switch operating mechanism shall be designed to retain its effectiveness with continuous use at a rated capacity without the use of auxiliary springs in the current path. Switches shall be capable of withstanding the available fault current or let-through current before the fuse operates without damage or change in rating. Fuse clips shall be designed and coordinated to accommodate the class and type of use specified or indicated to be used with the switch.

2.02 STARTERS

- A. Magnetic Motor Starters shall be NEMA rated, AC general purpose, class A, magnetic controller for induction motors rated in horsepower. Starters shall be full voltage, non-reversing type with NEMA ICS 2 overload relays and NEMA 1 enclosure.
- B. Combination motor starters shall have heavy duty safety switch disconnect in common enclosure.
- C. Auxiliary contacts shall be NEMA ICS 2 with two normally open and two normally closed and 120 volt control transformer.
- D. Starters shall have indicating lights, run-red, and HAND/OFF/AUTO type selector switch in front cover.

2.05 THERMAL MANUAL MOTOR STARTERS

- A. Thermal manual motor starting switches shall have built in thermal

overload protection, properly sized for the motor. Starters shall be UL E1811 listed, have back and front enclosures with pilot light, toggle operated, manual reset, Square D Class 2510, G.E., Westinghouse, or equal.

2.06 ACCEPTABLE MANUFACTURERS

- A. General Electric, Square D, Cutler Hammer, Siemens.

PART 3 - EXECUTION

3.01 GENERAL

- A. Use one manufacturer for all safety switches on the project. Provide non-fused safety switches unless specifically noted fused.

END OF SECTION

SECTION 16142 - WIRING DEVICES AND COVERS

PART I. - GENERAL

A. REFERENCE STANDARDS

1. Federal Specifications
 - a. W-C-596 E/GEN "Connector, Plug, Receptacle and Cable Outlet, Electrical Power"; W-P-455A "Plate, Wall Electrical"; W-S-896 E/GEN "Switches, Toggle (Toggle and Lock), Flush Mounted".
2. American National Standards Institute (ANSI):
 - a. No. C73 "Dimensions of Attachment Plugs and Receptacles".
3. NEMA Standards Publications:
 - a. WD1 - "General Purpose Wiring Devices". WD3 - "AC General - Use Snap Switches".

B. SUBMITTALS

1. Product Data (PD) catalog brochures, and Operating and Maintenance Manual (OMM).

PART II. - PRODUCTS

A. DEVICE COLOR

1. Ivory unless noted otherwise.

B. SWITCHES

1. 20 amp, 120-277 volts, AC only, toggle type, conforming to Federal Specification W-S-896E.
2. Switches shall meet the applicable requirements of NEMA Standard WD1-1974 for heavy duty switches and further requirements herein specified and shall be single pole, or 3-way or 4-way, of the maintained, momentary or lock type as indicated by symbols on drawings. Switches shall operate in any position. The noise level of the A.C. general use switch shall be considerably lower than that of the conventional A.C.-D.C. switch. The mounting yoke shall be insulated from the mechanism, equipped with plaster ears and fastened to the switch body by bolts, screws, rivets or other substantial means that meet test requirements. Provision of a green colored equipment grounding screw on the yoke is required. Contacts shall be made between silver alloys. Switches shall be back and side wired with terminals of screw or combination screw-clamp type. Terminal screws shall be not smaller than No. 8 and shall be captive or terminal type. Back wired devices shall have separate access holes for wiring. Hubbell Series HBL122-, or approved equal.
3. Pilot and Lighted Switches: equal to Hubbell Series HBL1201.
 - a. Pilot with handle illuminated when the load is on.
 - b. Lighted with handle illuminated when the load is off.
4. Dimmer Switches: Architectural style, slide to off, integral heat sink, voltage compensation, RFI suppression, and heavy duty components for surge suppression, for incandescent lamps with ratings of 600, 1000, 1500, and 1950 watts. Leviton Decora 80000 Series, or approved equal, 120 volt, single pole or three way. Complete with matching cover plate, color shall match other devices.

5. Motion/Occupancy sensors - Wide view or hallway, 15 volt DC, wall or ceiling (wide view only) mounted, adjustable to 30 minutes OFF time and ambient light override (2 foot candles to full brightness), Leviton Models 6777, 6778, and 6787, with 6781 surface box mounted adapter plate. Color shall match other devices. Leviton Model 6779 Control unit shall be rated for 1800 watts incandescent or 1800 va fluorescent lamps, 120 volts, for junction box installation with gasket.
6. Special Switches - Refer to contract drawings for additional requirements.

C. RECEPTACLES

1. 20 amp, 125V, AC, NEMA 5-20R, conforming to NEC 2008, Federal Specification W-C-596E, with wrap-around steel strap anchored near the receptacle face, and with green hexagonal equipment grounding screw. The grounding terminals and poles of all receptacles shall be internally connected to the receptacle mounting yoke. Terminals shall be back and side-wiring type. Approved equal of:
 - a. Heavy Duty Specification Grade: Hubbell HBL5352
 - b. Weather Resistant: Hubbell HBL5362WR
 - c. Tamper Resistant, Commercial Grade: Hubbell BR20TR
 - d. Hospital Grade: Hubbell HBL8300
 - e. Isolated Ground/Hospital Grade: Hubbell IG5362/CR5352IG
2. GFCI: Class A ground fault current interrupting, UL Standard 943, duplex, 20 amp, 125V, AC, 20 amp feed through, and "Block" or "Modular" design.
 - a. Heavy Duty: Hubbell GF20-L
 - b. Hospital Grade: Hubbell GFR8300-L
 - c. Tamper and Weather Resistant: Hubbell GFR8300-TR

D. COVERPLATES

1. Installed for all devices and outlets.

E. WALL PLATES

1. Wall plate shall be provided for each switch, receptacle, and special purpose outlet. Sectional gang plates shall not be used. Multi-gang outlet plates shall be used for multi-gang boxes. Wall plates shall be in accordance with Fed. Spec. W-P-455A.
2. Plates shall be matched to device(s) and of same finish or shall be stainless steel finish, except those indicated in next paragraph.
3. Plates for exposed screw jointed fittings shall match the fittings with edges of plates flush with edges of fittings. Plates shall be heavy cadmium plated steel. Plates for cast type boxes at locations subject to wet or rain conditions shall generally also be of the cast, vapor-tight type. Covers for "push" action type flush switches may be of the neoprene at these locations.
4. Weatherproof Coverplates:
 - a. Clear polycarbonate or Lexan hinged cover, NEMA 3R, UL listed, complies with NEC 406-8b for in-use protection of 15 and 20 amp, 120 volt duplex receptacles while in use, with sloped top, gaskets, cord ports through base, and "Wet Locations" label.

F. ACCEPTABLE MANUFACTURERS

1. Devices: Arrow Hart, Hubbell, Leviton, Pass & Seymour.
2. Device Plates: Arrow Hart, Pass & Seymour, Hubbell.

PART III. - EXECUTION

A. GENERAL

1. Install devices and coverplates as recommended by the manufacturers. Install single pole switches so that the circuit is on when the handle is up. Install flush wall receptacles above counters or work tables with long dimension parallel with the floor.
2. Cover all unused openings with blank coverplates.

B. CASEWORK AND WOODWORK

1. Do not cut openings for raceways in casework or woodwork prior to coordination with casework or woodwork supplier. Conceal raceways and junction boxes wherever feasible.

C. INSTALLATION

1. Install devices tight to wall, plumb, and level. Install receptacles and switches so that device face is even with the coverplate. Install blank fillers in coverplate openings not used. Grout or caulk boxes and rough-in, as required to provide watertight seal for weatherproof devices and coverplates.

END OF SECTION

SECTION 16420 - LIGHTING EQUIPMENT & FIXTURES

PART I. - GENERAL

A. DESCRIPTION OF SYSTEM

1. A lighting fixture type is indicated adjacent to each lighting fixture shown on the Drawings (i.e.: "A", "B", "C", etc.). Where all the fixtures in a room are of the same type, the type may be indicated only once.

B. SUBMITTALS

1. Product Data (PD) and Operating and Maintenance Manuals (OMM) consisting of at least complete catalog information for all lighting fixtures, equipment, and accessories used on project.

PART II. - PRODUCTS

A. LIGHTING FIXTURES

1. As described in the lighting fixture schedule. Lighting fixture manufacturers' catalog numbers or model descriptions indicate quality, type and style, but may not cover special required design details. Provide lighting fixtures having special details as noted in the fixture descriptions.
2. Alternate fixture manufacturers from those scheduled may be used. Commercial and industrial fixtures manufactured by Cooper Lighting, Hubbell Lighting, Inc., and Lithonia Lighting are approved.
3. Fixtures, in general, have been specified for the particular type of ceiling where they are being installed. Verify the ceiling system construction types and provide lighting fixtures, fittings, hangers, clamps, brackets, yokes, plaster flanges and miscellaneous devices as required for a complete installation.

B. FLUORESCENT LAMPS

1. Four foot T8 fluorescent lamps shall be rated for 28 watts, 40,000 hours life, 2725 initial lumens, 4100K color temperature, 85 color rendition index, and 0.94 lumen maintenance, Sylvania Octron series FO28/841XP/SS/ECO3 or approved equal. Other lamp lengths shall be of comparable efficacy. Lamps shall be compatible with energy saving electronic instant start or programmed start ballasts.
2. Compact fluorescent lamps shall be Sylvania Dulux Series. Lamp wattage and pin base shall match the fixture and ballast. Nominal lamp life shall be 10,000 hours, 82 color rendition index and 3500K color temperature.

C. BALLASTS

1. Fluorescent ballasts shall be electronic type ballasts for use with reduced wattage, energy savings T8 lamps. Lamps and ballasts shall be tested in accordance with IESNA and ANSI standards and shall meet OSHA/NRTL and UL guidelines. Ballasts shall be Osram Sylvania Instant Start, Programmed Start, or approved equal, with parallel circuitry, greater than 90 percent ballast factor, 95 percent power

factor, and less than 10 percent total harmonic distortion.

D. LENSES AND DIFFUSERS

1. 100 Percent virgin, light stable acrylic unless indicated otherwise. Nominal lens thickness shall be 0.125" unless otherwise specified.

PART III. - EXECUTION

A. GENERAL

1. Install lighting fixtures as described in the lighting fixture schedule, complete with lamps and ballasts as required, for lighting fixtures shown on the Drawings. Install all necessary accessory fittings, hangers, clamps, brackets, yokes, plaster flanges, outlet boxes, and miscellaneous devices required for a complete installation as recommended by the manufacturers.

B. FIXTURE SUPPORT

1. Securely support and/or suspend all lighting fixtures from structural members of building, except that lay-in, flange, and high hat fixtures may be supported by the ceiling grid system. Provide auxiliary (independent of grid), secondary support from structure of lay-in fixtures. Provide one stem at each end plus one stem at each fixture chassis junction for continuous rows of pendent mounted fluorescent lighting fixtures. Four foot long chassis may be used for continuous rows of fluorescent lighting fixtures. Suspended pendant mounted lighting fixtures at heights indicated measured from finished floor to center of fixture outlet box unless noted otherwise. Provide flexible connections to all recessed lighting fixtures as required by the code and in accordance with approved wiring methods.

C. LAMPS

1. Install lamps specified and as recommended by the lamp and lighting fixture manufacturers. Follow lamp manufacturers's recommendations for handling and installing lamps.

D. BALLASTS

1. Make all field connections necessary for factory installed ballasts and install all special ballasts as recommended by the manufacturers.

END OF SECTION

SECTION 16950 - TELEPHONE, DATA, TV

PART I. - GENERAL

A. SCOPE

1. Under this section, provide miscellaneous special electrical equipment and systems, including telephone wiring, data wiring, communication wiring and associated conduit, boxes, etc.

B. SUBMITTALS

1. Product Data, Catalog Cuts, Wiring Schematics, and Maintenance Manuals for cables, outlets, and sound system.

C. CODES AND STANDARDS

1. The 2008 edition of the National Electrical Code(NFPA70-2008), specifically Article 800, shall be the governing factor in the selection of materials, use of materials, installation, workmanship and safety, as related to data and telephone communication wiring installations.

PART II. - PRODUCTS

A. TELEPHONE, DATA, AND CATV CONDUIT SYSTEMS

1. Provide conduit systems from accessible ceiling space to telephone outlets, data outlets, CATV outlets, data hubs and punch panels as indicated on the plans. Power and data/telephone wiring shall be run in separate conduits. All conduits shall be provided with nylon pull ropes.
2. All conduit terminations shall be fitted with insulated type bushings and shall end in ceiling space with 90 degree long electrical sweep. Conduits shall be 1" electrical metal tubing (EMT).
3. Install pull boxes as required by the National Electrical Code.
4. Conduit, boxes, etc., shall be grounded.
5. Wall outlet boxes shall be deep, single gang switch box with cable clamps. Boxes shall be recessed mounted.

B. DATA AND TELEPHONE CABLE AND DEVICES

1. Provide Superior Essex NextGain Category 6 UTP, plenum rated, unshielded, 4 pair, twisted, 23 AWG solid cable, or approved equal. Data and telephone communication cables shall be colored differently in accordance with the County's standard colors.
2. Cable shall be designed to support high speed communication network applications for bandwidth with positive ACR verified beyond 300 Mhz. Cable shall conform to all TIA and ISO specifications for Category 6 NEXT systems and components. Cable performance shall be verified by ETL testing laboratories for gigabit ethernet

applications with zero bit error rate, and shall support voice, telephone, multimedia, digital and analog broadband video, 622 Mbps and 1.2Gbps ATM, VoIP, and token ring communications.

3. Communication and data outlet plate shall be high impact nylon construction, modular, front loading, and shall fit industry standard rectangular box opening. Single gang outlets shall have three modular openings and shall be suitable for variety of audio/video/data/fibre connectors and jacks. Provide two, two port, recessed angle keystone data modules per outlet; Hubbell Wiring Devices DF plate system with DFRA2 modules, or approved equal.
4. Data/communication jacks, RJ45, shall be Category 6, snap-in Keystone mounted, with 110 style modular connections, 8 position and 8 conductor for up to 1000 Mbps high-speed LAN, 1000BASE-TX applications, 60/40 tin/lead over nickel plated IDC 110 contacts, and 50 micro-inch gold plated beryllium copper nose contacts. Jacks shall exceed TIA/EIA 568A/B rated at 650MHz and TSB40A requirements; Hubbell Wiring Devices model HBL6, or approved equal. Color of data jacks shall be red, color of telephone communication jacks shall be ivory.
5. Punch down panels shall be wall mounted, meet CAT6 specifications and support 250 MHz bandwidths, with built-in cable management and labels on front cover. Connectors shall be 8-position modular jacks, 110 clips. Punch panels shall be equal to Black Box Model JPM.

C. CABLE TELEVISION (CATV)

1. CATV cable shall be RG 6/U, 18 gauge solid copper coaxial conductor and quad shielded with layers of aluminum foil, 60% braid, aluminum foil, and 40% braid with 75 ohms impedance, 17.3 pF per foot capacitance, 3.0 dB/100 ft. attenuation at 200 MHz. Cable shall have NEC rating CATV/CM
2. CATV connectors shall be type F, suitable for secure mounting on deep switch box and cover plate with 3/8" mounting hole per Section 16142.

PART III. - EXECUTION

A. GENERAL

1. Upon completion of work the contractor shall conduct tests to determine that the work is installed properly. Data wiring installation shall be tested to meet TIA/EIA 568A/B category 5 standards. Each data cable termination shall indicate "PASS" on test equipment. Telephone wiring installation shall be tested for proper terminations with proper balance, tone check, and wire continuity. Where tests indicate wires, boxes, conduit, jacks, or connectors are not installed properly, the contractor shall reinstall the equipment in accordance with these specifications. Contractor shall provide to the Owner certification that all equipment and installations "PASS."
2. Upon completion of the work by the contractor, the Owner may conduct independent testing of all cables. Should this testing indicated

improperly installed equipment or systems, the contractor shall reinstall the equipment in accordance with these specifications.

3. All materials, and equipment necessary for proper operation of the special system, and equipment for proper operation of the systems may not be specified or designated, in detail in this Section, but shall be deemed part of these specifications if required to fulfill the intent thereof to provide complete and safe operating systems. All equipment including cable and hardware installed under this Section shall be new material.

B. DATA, TELEPHONE, AND CATV WIRING INSTALLATION

1. Devices.

- a. Furnish and install all cables, conduits, boxes, outlets and jacks where indicated and as required. Make connections of data, telephone, and CATV cables to jacks and terminations at punch panel in data router cabinet, or at telephone board punch panel, or CATV service entrance. Follow outlet identification convention established by Owner and label individual outlets and their corresponding termination at punch panel.
- b. The Owner shall furnish data router cabinet. Contractor shall make terminations of cables to the patch panels and data hubs.

2. Data and Telephone Cable Placement.

- a. No single cable run shall exceed 100 meters (330 feet). All cable shall be run at least 36" away from any fluorescent lighting ballast or mechanical motor. Cable runs shall contain sufficient "slack" to allow servicing and access to ceiling area.
- b. Cables in parallel runs shall be neatly bundled together with cable ties, wire trains, etc. and shall be supported from structure above with minimum sag.
- c. The Owner shall furnish and install head-end data and telephone equipment such as computers, hubs, switches, network routers, printers, telephone hand sets, or the telephone system.

END OF SECTION