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## **Addendum #1 – SPECIFICATIONS**

Re-Bid Renovation to Existing Bathroom at Quinnipiac Park  
Bid #2223-05  
Date: 08/31/2022

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End of Addendum #1



# **Project Manual and Specifications**

**RENOVATION TO EXISTING BATHROOM AT QUINNIPIAC PARK**

**Bid #2223-05**

**Quinnipiac Park**

**Cheshire, CT 06411**

**Project #: 2122-10**

**March 7, 2022**

RENOVATION TO EXISTING BATHROOM AT QUINNIPIAC PARK  
Bid #2122-10

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SECTION 01010  
SPECIAL CONDITIONS

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.02 USE OF BUILDING BY THE OWNER

- a. The existing building will be occupied by the Owner during construction operation. The Contractor's attention is directed towards Section 01040, Project Coordination, for written description of the proposed construction scenario. All work must be coordinated with the Architect and the Owner to insure that satisfactory operational and environmental conditions are maintained during all phases of construction. In all cases the schedule / function of the school while classes are in session shall take precedence over construction activities.
- b. The Contractor shall develop a detailed construction schedule acceptable to the Owner.
- c. In general, construction must be phased to provide new space that is ready for occupancy before commencing work in existing areas to be altered. Work on the new areas must proceed in a manner to insure no permanent damage from the elements to existing adjacent spaces and no injury to occupants. Repair of any permanent damage shall be the Contractor's responsibility. Access to and exiting from the building may be temporarily relocated during various phases of construction. Safe egress from the existing building acceptable to the Fire Marshal and the Owner, must be maintained at all times.
- d. Contractor shall provide tight, secure, dust screens to separate all areas of the work and occupied spaces.

1.03 EXISTING CONDITIONS AND MEASUREMENTS

- a. Each Bidder will be held to have examined the premises and satisfied himself with the conditions which would in any manner affect the work under the Contract, and no later claims for extra compensation for labor, materials and equipment which could have been foreseen by such examination will be recognized. This Contractor shall take all necessary measurements for his work, at the site, and shall verify all measurements given on the Drawings.

#### 1.04 INTENT

- a. These Specifications with the accompanying Drawings are intended to describe and illustrate all material, labor, and equipment necessary to complete the project.
- b. For convenience of reference, these Specifications are separated into titled Divisions and Sections. Such separations shall not, however, operate to make the Architect an arbiter to establish limits to Contracts between the Contractor and Subcontractors. The Divisions of the Specifications do not necessarily define the limits of the Contractor's subcontracts, the work of any one subcontract may include items specified in several Divisions or sections. The Contractor may sublet work as he sees fit, but it is his responsibility to see that all work shown on the Drawings and/or specified is completed in accordance with the Contract.
- c. All materials shall be furnished and all work shall be accomplished in strict accordance with the grades or standards of materials, standards of workmanship, and manufacturer's specifications listed or mentioned in these documents.
- d. The listing or mention of materials shall be sufficient indication that all such materials shall be furnished by the Contractor, in accordance with the grades or standards indicated, free from defects impairing strength, durability or appearance and in sufficient quantity for the proper and complete execution of the work, unless specifically stated otherwise.
- e. The listing or mention of any method of installation, erection, fabrication or workmanship shall not operate to make the contractor an agent, but shall be for the sole purpose of setting a standard of quality for the finished work. Contractor is free to use any alternate method, provided only that, prior to the start of the work, such alternate method is approved in writing by the Architect, as resulting in quality equal to that intended by these documents. Unless an alternate method is approved, all work shall be in strict accordance with all methods of installation, erection, fabrication and workmanship listed or mentioned herein.

#### 1.05 CORRELATION OF DRAWINGS AND SPECIFICATIONS

- a. In general, the Specifications will describe the "quality" of the work and the Drawings, the "extent" of the work. The Drawings and Specifications are cooperative and supplementary, however, and each item of the work is not necessarily mentioned in both the Drawings and the Specifications. All work necessary to complete the project, so described, is to be included in this Contract.

- b. In case of disagreement between Drawings and Specifications, or within either document itself, the better quality or greater quantity of work for decision and/or adjustment. Any work done by the Contractor without consulting the Architect, when the same requires a decision, shall be done at the Contractor's risk.
- c. Omissions or Errors: If any omissions or errors are noted or instructions at variance with the obvious intent of the documents, it is the responsibility of the Contractor to call them to the Architect's attention before signing the Contract.

#### 1.06 INTERPRETATION OF "OR EQUAL"

- a. The use of trade names, with a notation such as "or equal" in these Specifications is to establish quality required; there is no attempt to limit competitive bidding, but in like manner quality specified will be rigidly maintained.
- b. The words "approved," "equal to," "as directed," etc., are interpreted and will be taken to mean "to the satisfaction of the Architect."
- c. Where three or more proprietary names are specified, and the words "or equal" are omitted, no substitute products will be considered. Bids must be based on one of the named products.

#### 1.07 WORK SCHEDULE AND COST BREAKDOWN

- a. The work shall be promptly started and shall be manned to guarantee completion on or before the time stated in the Bid Proposal. The Contractor shall furnish to the Architect a project schedule showing an anticipated schedule for the designated period. The project plan shall be presented prior to beginning work.
- b. If, in the opinion of the Architect, it becomes necessary for maintaining the schedule and for the completion of the school within the specified time, to work additional men, Contractors must immediately do so upon written request.
- c. **Submit immediately after the Contract is let, an itemized breakdown of estimated cost in detail.**

#### 1.08 TEMPORARY UTILITIES

- a. General - All concerned with furnishing utilities for use on the project as specified in this section are cautioned to determine location of sources of supply and conditions under which services can be brought to points of

use on the site. Each shall inspect premises and drawings for requirements of local installations and shall ascertain rules and fees under which various public private or municipal utilities will supply service. Upon completion of project, remove all temporary work.

- b. Water - Existing service is available for the Contractor's use.
- c. Electrical Service
  - 1. Existing service is available for Contractor's use. The Contractor shall arrange and pay for temporary connections.
  - 2. Contractors shall be responsible for furnishing such light bulbs and extension cords as may be essential to the execution of their respective branches of the work and for extensions of lines to sheds or to power tools and remote areas which cannot be reached with extension cords.
- d. Utility Charges for electric power and water service will be paid by the Owner.
- e. Job Telephone - The Contractor shall provide telephone service for use of all employed about the building and shall pay the installation, maintenance, change in location, removal and all charges for use of this telephone, except that charges for long distance calls shall be paid for by the person making the same. The telephone shall remain until the full completion of the work.

#### 1.09 TOILET FACILITIES

- a. The General Contractor shall provide portable toilet facilities for the use of their work forces. It shall be the responsibility of the General Contractor to insure these toilet facilities are kept clean and in sanitary conditions.

#### 1.10 PROTECTION

- a. Contractor shall at all times protect the building from damages from rain water. Contractor shall provide all equipment and enclosures to insure this protection.
- b. Contractor shall construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavation and below grade construction free of water.
- c. During cold weather, Contractor shall remove all snow and ice as may be required for proper protection and prosecution of the work.



- d. Contractor shall provide all shoring, bracing and sheeting as required for safety and for proper execution of work and have same removed when work is completed.
- e. During cold weather, Contractor shall protect all work from damage. If low temperatures make it impossible to continue operations safely in spite of cold weather precautions, Contractor shall cease work and shall so notify Architect. The Contractor shall be responsible for the repair and/or replacement, as may be required, of all work damaged from frost, freezing or any elements of the weather.
- f. Protection at Night and when Work is not in Progress. The Contractor shall be solely responsible for damage, loss or liability, due to the theft or vandalism when work is not in progress at night, weekends, or holidays.
- g. Existing Exitways shall be maintained to provide safe egress from occupied portions of the building at all times. The Contractor will be required to erect temporary enclosures, stairs, and ramps that may be required to accomplish safe passage through construction. Exiting shall be satisfactory to both the Fire Marshal and the owner.
- h. Fire Protection - All fire used within the structure for working purposes shall be extinguished when not in use. No flammable material shall be stored in the structure in excess of amounts allowed by the authorities. No gasoline shall be stored in or close to the building at any time.
- i. Precaution must be exercised at all times for the protection of persons and property. The safety provisions of applicable laws, school and construction codes must be observed; Contractor shall take or cause to be taken such additional safety and health measures as are reasonably necessary. Machinery, equipment and other hazards, guarded in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable laws.
- j. It shall be the responsibility of the Contractor to protect and preserve, in operating condition, all utilities traversing the work area. Damage to any utility due to work under this Contract shall be repaired to the satisfaction of the Architect at no additional cost to the Owner.

#### 1.11 USE OF PREMISES, SPECIAL WORKING CONDITIONS

- a. The Contractor shall confine his apparatus, storage of materials, supplies, equipment and operations to the areas bounded by the Contract and on-site limits as directed by the Architect. Coordination with the owner is essential in this matter.

- b. The Contractor shall be responsible for keeping the premises clean and shall pick up rubbish and debris daily.

#### 1.12 MAINTENANCE OF TRAFFIC AND EXITWAYS

- a. On-site and off-site traffic and exitways shall not be blocked by construction vehicles, parked cars, material storage and other construction operations. Interior and exterior building exitway shall be maintained at all times during the work day.

#### 1.13 SAMPLES

- a. All materials that will be used in the construction of this project are subject to the approval of the Architect. All samples required by the Specifications or by the above requirements shall be submitted for approval. Where color selections are made, complete samples shall be furnished to the Architect.

#### 1.14 EQUIPMENT AND HOISTS

- a. The Contractor shall provide at his own expense and risk, all tools, equipment, apparatus, and temporary work that may be required for the execution of the work under his Contract.
- b. The Contractor shall provide temporary hoists with power and attendance for same as required to handle his own materials and rubbish.

#### 1.15 FIRE EXTINGUISHER

- a. Provision of fire extinguisher in the area under construction is required from the standpoint of controlling incipient fires promptly.

#### 1.16 REPAIRS

- a. Contractor shall make all repairs to existing streets, walks, curbs, grassed areas, etc., made necessary by this work.

#### 1.17 GENERAL COORDINATION

- a. There shall be cooperation and coordination with respect to time, space, work, etc., between the General Contractor, Subcontractors and all other Contractors and no claim for extra compensation or extension of Contract time will be allowed for conditions resulting from lack of said cooperation and coordination.

- b. The Contractor shall promptly notify the Architect of all errors, omissions or discrepancies which he finds on the Contract Documents and he shall not proceed with the work involved in such errors, omissions, or discrepancies until instructions are given by the Architect. The Contractor shall be responsible for all work erroneously installed prior to receiving said instructions.

#### 1.18 DELIVERY, STORAGE AND HANDLING

- a. All materials and equipment shall be so delivered, stored and handled as to prevent intrusion of foreign materials and damage by weather or breakage. Packaged materials shall be delivered and stored in original packages. Packages opened for Architect's inspection shall be resealed until ready for use. Packages, materials and equipment showing evidence of damage shall be rejected.
- b. All materials which could be affected by dampness shall be stored in suitable substantial watertight storage facilities maintained in good condition throughout their use.
- c. Rigid insulation board shall not be stored within the building. Provision shall be made for its protection from the weather and vandals elsewhere on the site.

#### 1.19 FINAL CLEANING

- a. All accumulated rubbish shall be removed from the building and points immediately adjacent thereto by the General Contractor who shall transport same from premises. Flammable rubbish shall not be burned on the premises. It shall be hauled away. No rubbish shall be deposited as fill on premises.
- b. Leave the work area clean and ready for use. If the Contractor fails to clean up, the Owner may do so and the cost thereof shall be charged to the Contractor.
- c. See Section 01710 for additional requirements.

#### 1.20 GUARANTEE

- a. If, in the Contractor's opinion, any work is shown on the Drawings or called for in the Specifications in such a manner as to make it impossible for him to produce and guarantee a first-class piece of work, he shall refer the same to the Architect before proceeding.
- b. The Contractor and each Subcontractor shall guarantee that all materials and workmanship shall be free from original defects or against injury from proper and usual wear when used for purposes intended for one year after date of final certificate. Where guarantees or warranties are written in any

of the divisions for longer terms, such longer terms shall apply from this date.

- c. The Contractor shall, in case of work performed by their Subcontractors or where guarantees are required, secure guarantees from said Subcontractors and deliver copies of same to the Architect upon completion of the work.
- d. All portions of the work shall also be maintained in perfect condition during this period. Such written guarantees as may be requested shall be submitted in duplicate at the completion of the work. These will be supplementary to and not in any way canceling specific guarantees which apply to various portions of the work.
- e. See Specifications Sections for additional Guarantee requirements.

#### 1.21 SOCIAL SECURITY TAXES

- a. The Contractor and each Subcontractor shall pay the taxes measured by the wages of all their employees as required by the Federal Social Security Act and all amendments thereto, and accept the exclusive liability for said taxes. The Contractor shall also indemnify and hold the owner harmless on account of any tax measured by the wages aforesaid of employees of the Contractor and his subcontractors, assessed against of the Owner under authority of said law.

#### 1.22 UNEMPLOYMENT INSURANCE

- a. The Contractor and each Subcontractor shall pay unemployment insurance measured by the wages of his employees as required by law and accept the exclusive liability for said contributions. The Contractor shall also indemnify and hold harmless the owner on account of any contribution measured by the wages of aforesaid employees of the Contractor and his Subcontractors, assessed against the Owner under authority of law.

#### 1.23 OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

- a. The Contractor shall comply with the requirements of the Occupational Safety and Health Act (OSHA) of 1970 and the Construction Safety Act of 1969, including all standards and regulations which have been promulgated by the Governmental Authorities which administer such Acts and said requirements, standards and regulations are incorporated herein by reference.
- b. The Contractor shall comply with said regulations, requirements and standards and require and be directly responsible for compliance

therewith on the part of his agents, employees, material men and Subcontractors; and shall directly receive and be responsible for all citations, assessments, fines or penalties which may be incurred by reason of his agents, employees, material men or Subcontractors failing to so comply.

- c. The Contractor shall indemnify the Owner and Architect and save them harmless from any and all losses, costs and expenses, including fines and reasonable attorney's fees incurred by the owner and Architect by reason of the real or alleged violation of such laws, ordinances, regulations and directives, Federal, State, and Local, which are currently in effect or which become effective in the future, by the Contractor, his Subcontractors or material men.

#### 1.24 JOB MEETINGS

- a. Meetings conducted at the job site by the Architect's representative for the purpose of coordinating and observing the work shall be mandatory for the Contractor and/or his superintendent. Also, at times, the Architect's representative will designate certain Subcontractors to attend.

#### 1.25 LIST OF CONTACTS

- a. Contractor shall furnish Owner a list of persons to contact with telephone numbers for emergency use during construction period (off hours, weekends, holidays).

#### 1.26 PLANS AND SPECIFICATIONS AT THE SITE

- a. **The Contractor shall maintain at the site one copy of all Drawings, Specifications, Addenda, approved shop drawings, change orders and other modifications, schedules, and instructions in good order and marked to record all changes made during construction. These shall be available at all times to the Architect or his authorized representatives.**
- b. As-Built Drawing Documentation - Carefully note that the Contractor is responsible for maintaining a record set of Contract Documents clearly marking all revisions, alterations, corrections, modifications, substitutions, etc., resulting from changes undertaken during the course of construction. At the conclusion of the project, the Contractor shall formally issue to the Architect a set of Contract Documents with all such As-built changes clearly marked and recorded.

#### 1.27 DRAWINGS FURNISHED

- a. The Drawings and Specifications can be downloaded from the Towns website. The Contractor shall pay the cost of reproduction.

END OF SECTION 01010

SECTION 01040  
PROJECT COORDINATION

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY OF WORK

- a. The intent of this bid is to complete the work defined in the Contract Documents. The selected General Contractor must work harmoniously with the Owner to complete the Work within the calendar days noted in the Proposal.
- b. Portions of this building will be occupied and must remain fully operational throughout the construction period. This section of the specification contains a suggested Construction Phasing Plan which illustrates an approach to the renovations with respect to the operational requirements of the school. The Contractor will be required to establish and present to the Architect in writing for approval, his own phasing program that will allow the Contractor to complete the most disruptive work within the building during school vacation periods and when school is not in session.
- c. The Contractor shall prepare a detailed construction schedule which shall be presented to the Architect and the Owner for their review, comments and approval. The schedule must clearly demonstrate the proper sequencing of construction and relocation activities and how operational and environmental conditions will be satisfactorily maintained in all occupied spaces.
- d. Contractor shall provide tight, secure, dust screens to separate all areas of the work and occupied spaces.
- e. All work must be coordinated with the Architect and the School administration to insure satisfactory operational conditions. The Contractor will be required to coordinate and schedule his work to keep a minimum of the facilities shut down at any specific time. Any area that must be shut down may be only with the approval of and during the time designated by the Owner. The Contractor shall phase his work, as required, in the building. The Contractor shall insure safe access to

occupied areas by the employees, students and public. The Contractor shall insure that heat and all other utilities are provided to these areas. Repair of any damage to existing facilities and equipment resulting from interrupted utilities, lack of heat, or Contractor's work in the areas shall be Contractor's responsibility. Also, repair of any damage to services and utilities as a result of the work shall be the Contractor's responsibility. Contractor shall insure safe egress and security of existing areas and equipment during the construction. Existing exitways shall be maintained to provide safe egress from occupied portions of the building at all times.

- f. The Contractor shall restrict the parking of workmen and construction vehicles and the storage of construction materials to a suitable parking area to be determined during a pre-construction conference.

END OF SECTION 01040



SECTION 01300  
SUBMITTALS AND PRODUCT SUBSTITUTIONS

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;
1. Schedule of Values.
  2. Shop Drawings.
  3. Product Data.
  4. Samples.
- B. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- C. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
1. Applications for payment.
  2. Insurance certificates.
  3. List of Subcontractors.
- D. Inspection and test reports are included in Section 01400 "Quality Control Services."

1.3 SUBMITTAL PROCEDURES

- A. Coordination: Within 15 days of the Contract award, submit to the Architect a comprehensive Submittals listing each item to be submitted and the date proposed to be submitted. Coordinate with the Architect in the preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
    - b. Coordinate transmittal of all submittals requiring color selection so that comprehensive selection can be processed.
  3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
    - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the General Contractor when a submittal being processed must be delayed for coordination.
    - b. If an intermediate submittal is necessary, process the same as the initial submittal.
    - c. Allow two weeks for reprocessing each submittal.
    - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  2. Include the following information on all submittals:
    - a. Name of item being submitted.
    - b. Number and title of appropriate Specification Section.
    - c. Drawing number and detail references, as appropriate.
    - d. Name of manufacturer.
    - e. Name, address and telephone number of supplier.
    - f. Bid Package number and name.
    - g. Project Name.
    - h. Date.
    - i. Name, address and telephone number of Contractor.

- j. Name, address and telephone number of Subcontractor.
  - k. Name, address and telephone number of Architect.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.
- D. **The electronically submitting any documents through email in the form of PDF is preferred.**
- E. Should the contractor choose to submit hard copies, the number of copies should be: six (6) copies of all shop drawings and product data, of which three (3) will be returned to Contractor. Submit one (1) each of all samples.

#### 1.4 DEFINITIONS

- A. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
- 1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
  - 2. Revisions to Contract Documents requested by the Owner or Architect.
  - 3. Specified options of products and construction methods included in Contract Documents.
  - 4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

#### 1.5 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of the Construction Managers Construction Schedule.
- 1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    - a. Construction Managers construction schedule.
    - b. Application for Payment form.
    - c. List of subcontractors.

2. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than seven (7) days before the date scheduled for submittal of the initial Application for Payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
1. Forms: Use AIA Document G702 and Continuation Sheets G703, as the form for the Schedule of Values.
  2. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect.
    - c. Project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  3. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
    - a. Generic name.
    - b. Related Specification Section.
    - c. Change Orders (numbers) that have affected value.
    - d. Dollar value.
    - e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
  4. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
  5. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
  6. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  7. Show temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items in the Schedule of Values.

## 1.6 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents.

Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
1. Dimensions.
  2. Identification of products and materials included.
  3. Compliance with specified standards.
  4. Notation of coordination requirements.
  5. Notation of dimensions established by field measurement.
  6. Sheet Size: Except for templates, patterns and similar full size Drawings, submit Shop Drawings on sheets at least 8 ½" x 11", but no larger than 30" x 42".
  7. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

#### 1.7 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with recognized trade association standards.
    - c. Compliance with recognized testing agency standards.
    - d. Application of testing agency labels and seals.
    - e. Notation of dimensions verified by field measurement.
    - f. Notation of coordination requirements.
  2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
  3. Submittals: Submit copies of each required submittal; submit additional copies where required for maintenance manuals.

- a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
4. Distribution: Furnish copies of final submittal to Architect for distribution to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities.
    - a. Do not proceed with installation until an approved copy of Product Data applicable is in the installer's possession.
    - b. Do not permit use of unmarked copies of Product Data in connection with construction.

## 1.8 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
  1. Mount, display, or package samples in the manner specified to facilitate review of qualities indicated. Prepare samples to match the Architect's sample. Include the following:
    - a. Generic description of the sample.
    - b. Sample source.
    - c. Product name or name of manufacturer.
    - d. Compliance with recognized standards.
    - e. Availability and delivery time.
  2. Submit samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units that show approximate limits of the variations.
    - b. Refer to other Specification Sections for requirements for samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.

3. Preliminary submittals: Where samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
  - a. Preliminary submittals will be reviewed with the Architect indicating selection or other action.
  - b. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
4. Submittals: Except for samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, samples will not be returned, unless so requested in advance.
5. Maintain sets of returned samples, at the Project site, for quality comparisons throughout the course of construction.
  - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

#### 1.9 SUBMITTALS

- A. Substitution Request Submittal: Requests for substitution will be considered if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
  1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
  2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers, complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
    - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
    - b. Samples, where applicable or requested.
    - c. A detailed comparison of significant qualities of the proposed substitution with those of the work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate

- Contractors, that will become necessary to accommodate the proposed substitution.
- e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
  - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
  - g. Certification by the Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
3. Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the General Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name.

#### 1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
  1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, to indicate the action taken:
  1. Final Unrestricted Release: Where submittals are marked "Approved," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  2. Final-But-Restricted Release: When submittals are marked "Approved as Corrected," that part of the Work covered by the submittal may proceed provided it complies with notations or



- corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
3. Returned for Resubmittal: When submittal is marked “Not Approved, Revise and Resubmit,” do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked “Not Approved, Revise and Resubmit” to be used at the Project site, or elsewhere where Work is in progress.
  4. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked “Action Not Required”.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Conditions: The Contractor’s substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
  1. Extensive revisions to Contract Documents are not required.
  2. Proposed changes are in keeping with the general intent of Contract Documents.
  3. The request is timely, fully documented and properly submitted.
  4. The request is directly related to an “or equal” clause or similar language in the Contract Documents.
  5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  7. A substantial advantage is offered the owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and

evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
  9. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
  10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 - EXECUTION (Not Applicable).

END OF SECTION 01300

SECTION 01400  
QUALITY CONTROL SERVICES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect.
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
  - 2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for the Contractor to provide quality control services required by the Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 RESPONSIBILITIES

- A. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
1. Costs of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests, performed on original construction, do not indicate compliance with Contract Documents.
- B. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
  2. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
  3. Providing facilities for storage and curing of test samples.
  4. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  5. Security and protection of samples and test equipment at the Project site.
- C. Owner Responsibilities: The Owner will provide inspections, tests and similar quality control services specified to be performed by independent agencies and not by the Contractor, except where they are specifically indicated as the Contractor's responsibility or are provided by another identified entity. Costs for these services are not included in the Contract Sum.
1. The Owner will employ and pay for the services of an independent agency, testing laboratory or other qualified firm to perform services which are the owner's responsibility.
  2. The Contractor agrees to engage and pay for the quality control services specified as the Contractor's responsibility, including retesting, from the independent agency engaged by the Owner.
- D. Duties of the Testing Agency and Special Inspector: The independent testing Agency and the Special Inspector, engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections, shall cooperate with the Architect and Contractor in performance of their duties, and shall provide qualified personnel to perform required inspections and tests.

1. The Agency or the Special Inspector shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Neither the Agency nor the Special Inspector is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
  3. Neither the Agency nor the Special Inspector shall not perform any duties of the Contractor.
- E. Coordination: The Contractor and each Agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

END OF SECTION 01400

SECTION 01500  
TEMPORARY FACILITIES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
1. Telephone service.
- C. Temporary construction and support facilities required include but are not limited to:
1. Temporary enclosures.
  2. Temporary Project identification signs and bulletin boards.
  3. Waste disposal services.
  4. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
1. Temporary fire protection.
  2. Barricades, warning signs, lights.
  3. Enclosure fence for the site.
  4. Environmental protection.

1.3 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:
1. Building Code requirements.
  2. Health and safety regulations.
  3. Utility company regulations.
  4. Environmental protection regulations.

- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-ALO Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Refer to "Guidelines for Bid Conditions for Temporary Job Utilities and Services", prepared jointly by AGC and ASC, for industry recommendations.
  - 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. obtain required certifications and permits.

#### 1.4 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility within 15 days of the date established for commencement of the Work. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division - 6 Section "Rough Carpentry."
  - 1. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1, of sizes and thickness indicated.
  - 2. For fences, barriers, sidewalk bridges and similar uses, provide minimum 5/8 inch thick exterior plywood.

- C. Gypsum Wallboard: Provide gypsum wallboard complying with requirements of ASTM C 36 on interior walls of temporary partitions.
- D. Paint: Comply with requirements of Division - 9 Section "Finish Painting."
  - 1. For sign panels and applying graphics, provide exterior grade alkyd gloss enamel over exterior primer.
  - 2. For interior temporary partitions, provide two coats interior latex flat wall paint.
- E. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- F. Water: Owner to provide temporary water for the purposes of construction activity. Water service will be available for Contractor's use upon approval of the Owner.
- G. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe posts, 1 ½ inch I.D. for line posts and 2 ½ inch I.D. for corner posts.

## 2.2 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide ¾ inch heavy-duty, abrasion-resistant, flexible rubber hose 100 ft. long, with pressure rating greater than the maximum pressure of the water distribution system; provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.



- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. First Aid Supplies: Comply with governing regulations.
- G. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "All fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
  - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required, at no additional cost to the Owner.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed, or are replaced by authorized use of completed permanent facilities.

#### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Where required, engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.

- B. Water Service: Owner to provide water service for the purposes of construction activity. **The Owner shall be responsible for all costs associated with water service and distribution.**
- C. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
  - 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Telephones: Contractor to provide all telephones required for Contractor's use during the extent of construction and pay all costs for installation, use, and removal. Telephones required by separate contractor's shall be installed, removed, and paid for by that contractor.
  - 1. At Contractor's telephone, post a list of important telephone numbers.

### 3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
  - 1. Confine apparatus, storage materials, equipment, supplies and operations to the areas bounded by the Contract and on-site limits as shown on the drawings.
  - 2. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. With the cooperation of all trades and separate Contractors involved, the Contractor may utilize the permanent heating and ventilating system when completely installed and operational, providing the following conditions are met by the Contractor at no additional cost to the Owner:
  - 1. The Contractor shall minimize interruption of heat and hot water to areas of the building being utilized by the Owner and shall take adequate precaution to prevent any damage from occurring due to lack of heat.
  - 2. The Contractor shall take all necessary precautions to prevent waste of heat due to excessive ventilation of careless operation of openings in the building.

3. The system shall be protected from freezing. Any frost damage shall be repaired at the Contractor's cost.
  4. Arrangements shall be made to monitor the system operation at night and over weekends and holidays by the Contractor.
  5. All safety controls shall be installed and operating.
  6. All equipment shall be serviced and brought back to "as new" condition to the Architect's satisfaction before acceptance by the Owner.
  7. All equipment warranties and guarantees shall be extended so that their full term is available to the Owner from the date of acceptance.
  8. All permanent HVAC systems utilized for heat shall be cleaned throughout the system, including but not limited to the ductwork, cores, and coils of equipment, etc. Replacement of filters alone does not constitute a thorough cleaning.
  9. All costs for fuel shall be the responsibility of the Contractor until Substantial Completion if permanent systems are functioning and energy efficient measures are installed.
- C. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces on the site.
- H. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7 to 13 deg C).
- I. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
  3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
  4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.

J. Protection:

1. Protect the building at all times from damages from rain water, spring water, ground water, backing up of drains and sewers and all other water. Provide all pumps, equipment and enclosures to insure this protection.
2. Remove all snow and ice as may be required for proper protection and prosecution of the work.
3. Provide all shoring, bracing and sheeting as required for safety and for proper execution of work.
4. Protect all work from damage during cold weather. if low temperatures make it impossible to continue operations safely in spite of cold weather precautions, cease work and so notify Architect. Repair and/or replacement of all work damaged from frost, freezing or any elements of the weather are the responsibility of the Contractor.
5. Protect the building and the site from damage, loss or liability due to theft or vandalism when the work is not in progress at night, weekends, or holidays.
6. Exercise precaution for the protection of persons and property at all times. Observe the provisions of applicable laws and construction codes. Take additional safety and health measures, or cause such measures to be taken as reasonably necessary. Maintain guards on machinery, equipment and other hazards as set forth in the safety provisions of the Manual of Accident Prevention in Construction, published by the Associated Contractors of America, to the extent that such provisions are not in contravention of applicable laws.
7. Protect and preserve in operating conditions all utilities traversing the work area. Repair all damages to any utility due to work performed under this Contract, to the satisfaction of the Architect at no additional cost to the Owner.

K. Temporary Lifts and Hoists: Provide facilities for hoisting materials, rubbish, and employees. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

L. Project Identification and Temporary Signs: Contractor to provide project identification and other signs of the size indicated; install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood. Do not permit installation of unauthorized signs. Wording and layout to be provided by Architect.

1. Project Identification Sign: Erect a 4 feet x 8 feet x  $\frac{3}{4}$  inches plywood sign. Frame with 2 x 4 center cross bracing, and two 4 x 4 x 12 feet long posts in 12 inch diameter by 4 feet deep concrete piers. Mount sign to framing with four  $\frac{3}{8}$  inch diameter lug bolts and washers on each side of the sign.
  2. Engage an experienced sign painter to apply graphics. Apply three coats to the sign face, and one coat to the sides and rear. Architect to provide project sign layout and lettering.
  3. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- M. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner. **The Contractor shall furnish and maintain dumpster service on-site for the removal of all waste material and debris. It is the responsibility of each contractor utilized for the completion of this project to remove all associated waste material and debris from the job site on a daily basis and place into appropriate waste receptacle as directed by the Contractor.**

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.
- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
  1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor.
  2. Store combustible materials in containers in fire-safe locations.
  3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.

4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
  5. No gasoline may be stored in or close to the building at any time.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed provide lighting, including flashing red or amber lights.
- E. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- F. Environmental Protection: Provide protection, operate temporary facilities and, conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.5 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis where required to achieve indicated results and to avoid possibility of damage.

2. Protection: Prevent water filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, the contractor responsible for its installation shall remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.
  2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace existing and new street paving, curbs and sidewalks and grassed areas at the temporary entrances, as required by the governing authority.
  3. At Substantial Completion, clean and renovate existing and new permanent facilities that have been used during the construction period, including but not limited to:
    - a. Replace air filters and clean inside of ductwork and housings (new construction areas only).
    - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
    - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use.

END OF SECTION 01500

SECTION 01600  
REFERENCE STANDARDS, DEFINITIONS, MATERIALS AND EQUIPMENT

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section specifies applicability of industry standards to products specified, administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Submittals and administrative procedures for handling requests for substitutions made after award of the Contract are included under Section 01300, "Submittals and Product Substitutions."

1.3 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Architect, requested by the Architect, and similar phrases.
- D. Approved: The term approved, when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulations: The term regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.



- F. Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. Provide: The term provide means to furnish and install, complete and ready for the intended use.
- I. Installer: An Installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
  2. Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
  3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no choice or option. However, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
    - a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.
- J. Project site is the space available to the Contractor for performing construction activities either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site

is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

- K. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.
- L. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as “specialties,” “systems,” “structure,” “finishes,” “accessories,” and similar terms. Such terms such are self-explanatory and have well recognized meanings in the construction industry.
  - 1. “Products” are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term “product” includes the terms “material,” “equipment,” “system,” and terms of similar intent.
    - a. “Named Products” are items identified by manufacturer’s product name, including make or model designation, indicated in the manufacturer’s published product literature, that is current as the date of the Contract Documents.
  - 2. “Materials” are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
  - 3. “Equipment” is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

#### 1.4 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. These Specifications with the accompanying Drawings are intended to describe and illustrate all material, labor, and equipment necessary to complete construction for the Kitchen and Served Renovation Doolittle Elementary School, Cheshire, CT
- B. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute’s 16 Division format and MASTERFORMAT numbering system.
- C. Specification Content: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
  2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
    - a. The words “shall be” are implied wherever a colon (:) is used within a sentence or phrase.
- D. In general, the Specifications will describe the “quality” of the work and the Drawings, the “extent” of the work. The Drawings and Specifications are cooperative and supplementary, however, and each item of the work is not necessarily mentioned in both the Drawings and the Specifications. All work necessary to complete the project, so described, is to be included in this Contract.
- E. In case of disagreement between Drawings and Specifications, or within either document itself, the better quality or greater quantity of work for decision and/or adjustment. Any work done by the Contractor without consulting the Architect, when the same requires a decision, shall be done at the Contractor’s risk.
- F. Omissions or Errors: If any omissions or errors are noted or instructions at variance with the obvious intent of the documents, it is the responsibility of the Contractor to call them to the Architect’s attention before signing the Contract.

#### 1.5 SUBMITTALS

- A. Comply with requirements contained in Section 01300, “Submittals and Product Substitutions”.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Responsibility to furnish material: Listing or mention of materials is sufficient indication to make it the Contractor's responsibility to furnish said materials in accordance with the grades or standards indicated, free from defects impairing strength, durability or appearance, and in sufficient quantity for the proper and complete execution of the work, unless specifically stated otherwise.
- D. Responsibility for or methods: The listing or mention of any method of installation, erection, fabrication or workmanship shall not operate to make the contractor an agent, but shall be for the sole purpose of setting a standard of quality for the finished work. Contractor is free to use any alternate method, provided only that, prior to the start of the work, such alternate method is approved in writing by the Architect, as resulting in quality equal to that intended by these documents. Unless an alternate method is approved, all work shall be in strict accordance with all methods of installation, erection, fabrication and workmanship listed or mentioned herein.

#### 1.7 INDUSTRY STANDARDS

- A. Compliance: Furnish all materials and accomplish all work in accordance with the grades or standards of materials, standards of workmanship, and manufacturer's literature, as referenced in these documents.
- B. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- C. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.
- D. Conflicting Requirements: Where compliance with two or more standards is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.
  - 1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed.

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

- E. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.
  
- F. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

## 1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle products in accordance with the Architect's and manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
  - 1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
  - 3. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
  - 4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
  - 5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
8. Packages, materials and equipment showing evidence of damage may be rejected by the Architect.
9. Store rigid insulation board away from the building.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
  1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
  2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
  1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated, or equal to that described.
  2. Semi-proprietary Specification Requirements: Where three or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
    - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a

- product or assembly that provides the characteristics and otherwise complies with Contract requirements.
4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
    - a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
  5. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
  6. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
    - a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
  7. Visual Selection: Where specified product requirements include the phrase " .... as selected from manufacturer's standard colors, patterns, textures ..... " or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PRODUCTS:

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600



SECTION 01620  
STORAGE AND PROTECTION

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.02 SCOPE OF THE WORK

- A. Furnishings disturbed by the work shall be relocated and stored within the building by the General Contractor. This equipment will be cleaned and reinstalled by the General Contractor.
- B. New furnishings and equipment purchased by the Owner shall be installed by the Owner. New furnishings and equipment purchased supplied under this project shall be installed by the Contractor.

1.03 PROCEDURE

- A. Loose materials, books and supplies shall be boxed and removed from the area of Work by the Owner prior to the arrival of the Contractor's forces.
- B. Movable furnishings shall be marked by the Contractor for return or relocation in accordance with a Key Plan generated by the Contractor as required. Labels shall be at least 2" x 3" in size and shall be easily removable without damage to, or residue left on, the applied surfaces.
- C. Electronic equipment including but not limited to computers (PC's), typewriters, copy machines, etc. shall be removed from the area of Work by the Owner prior to the arrival of the Contractor's forces. The Contractor shall coordinate with the Owner any other items in question.
- D. The Contractor shall properly package or otherwise protect all items moved and stored to insure their safe relocation. All such packaging and protective gear shall be provided at no additional cost to Montville Public Schools and shall be removed by the Contractor upon completion of the reinstallation phase.
- E. The Contractor shall provide a complete written inventory of all boxes, furnishings, equipment, etc. just prior to removal for storage. This inventory shall be monitored by the Owner's Representative. The same inventory will be utilized when the materials are returned for reinstallation.

- F. Boxes packed by the Owner shall be unpacked by the Owner.

1.04 STORAGE

- A. All materials removed shall be stored in a dry secure environment. Storage location is at the Contractor's option. The Contractor together with the General Contractor can utilize areas within the building to store boxes, equipment and furnishings. The Contractor can also opt for the use of on site storage trailer boxes that are dry and secure, or off site insured warehousing controlled by the Contractor. In all cases, the Contractor shall be responsible for providing safe, dry and secure storage.

1.05 CLEANING

- A. The Contractor shall be responsible for reinstalling all furnishings and equipment in a clean, dust free, ready to use and in an acceptable condition to the Owner and Architect.

END OF SECTION 01620

SECTION 01700  
PROJECT CLOSEOUT

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout by the Contractor, including but not limited to:
1. Final inspection procedures.
  2. Project record document submittal.
  3. Operating and maintenance manual submittal.
  4. Submittal of warranties.
  5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions - 2 through - 16.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection by the Architect for certification of Substantial Completion, complete the following. List exceptions in the request.
1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  2. Advise the Owner of pending insurance change-over requirements.
  3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
  4. Obtain and submit releases to the Architect enabling the Owner unrestricted use of the Work and access to services and utilities;

- include occupancy permits, operating certificates and similar releases.
  - 5. Submit record drawings, maintenance manuals and similar final record information to the Architect.
  - 6. Deliver tools, spare parts, extra stock, and similar items.
  - 7. Remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
  - 8. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Final Inspection Procedures: Submit a request for final inspection, to the Architect. Following the Architect's final inspection, the Architect will either prepare the Certificate of Substantial Completion, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
- 1. The Architect will repeat final inspection when requested by the Contractor and assured that the Work has been substantially completed.
  - 2. Results of the completed final inspection will form the basis of requirements for final acceptance.

#### 1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
- 1. Submit the final payment request to the Architect with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  - 2. Submit an updated final statement to the Architect, accounting for final additional changes to the Contract Sum.
  - 3. Submit a certified copy of the Architect's Final Inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Contractor.
  - 4. Submit consent of surety to final payment.
  - 5. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Architect will re-inspect the work upon receipt of notice from the Contractor that the Work, including Final Inspection list items from earlier inspections, has been completed, except

items whose completion has been delayed because of circumstances acceptable to the Architect.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated.

#### 1.5 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
  2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
  3. Note related Change Order numbers where applicable.
  4. organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set. Submit to the Architect.
- C. Maintenance Manuals: Organize and submit to the Architect operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
  1. Emergency instructions.
  2. Copies of warranties.
  3. Recommended "turn around" cycles.
  4. Inspection procedures.
  5. Shop Drawings and Product Data.

6. All Maintenance Manuals are to be submitted in duplicate.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section 01500 "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
  1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
    - d. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.
- E. If the Contractor fails to demonstrate a commitment to accomplish the required cleaning in an orderly, timely fashion, the Owner reserves the right to employ a professional cleaning service, and to deduct any costs thereof from the Contract Amount.

END OF SECTION 01700

SECTION 01710  
CLEANING OF NEW AND EXISTING SPACES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.02 SCOPE OF THE WORK

- A. Furnish all labor, materials and other services required to give the new and existing spaces a thorough cleaning in preparation for occupancy or before the Owner takes re-occupancy after each phase. Carefully note that this specification applies to all sections of the building either renovated or completed by the contractor prior to re-occupancy by the Owner at the completion of the project. The use of a professional cleaning service is strongly advocated.
- B. Cleaning shall consist of, but is not limited to, the items below:
1. All accumulated rubbish shall be removed from the building and points immediately adjacent thereto and removed from the site.
  2. Give the entire project a thorough cleaning at the completion of all other work but before the glass is cleaned.
  3. Clean all glass, including windows, remove putty, stains and paint, wash and polish same. Care shall be taken not to scratch glass. Cleaning of glass shall be done after completion of all other work.
  4. Clean all paint, decorated and stained work; remove all marks, stains, fingerprints and other soil or dirt from all painted and stained work.
  5. Remove all temporary protections. Clean and polish all affected floors at completion.
  6. Clean and polish all painted woodwork at completion.
  7. Clean and polish all hardware for all trades; this shall include removal of all stains, dust, dirt, paint, etc., upon completion.
  8. Remove all spots, soil and paint from all tile work; wash same upon completion.
  9. Clean all fixtures and equipment, remove all stains, paint, dirt and dust.
  10. Thoroughly wash and clean all dirt and stains on all exterior vertical and horizontal surfaces affected by this contract.



11. Leave the final renovated area clean. Should the Contractor fail to demonstrate a commitment to accomplish the required cleaning in adequate time for re-occupancy, the Owner reserves the right to employ a professional cleaning service and to deduct the cost thereof from the Contract for Construction.

END OF SECTION 01710

SECTION 02070  
SELECTIVE DEMOLITION

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section requires the selective removal and subsequent off-site disposal of the following:
1. Portions of existing building elements indicated on drawings and as required to accommodate new construction.
  2. The removal and disposal of portable classroom structures
- B. Related Work Specified Elsewhere, including but not limited to:
1. Division 15 - Mechanical
  2. Division 16 - Electrical

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1.4 JOB CONDITIONS

- A. Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.
- B. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. **Owner has right of first refusal for all salvaged items removed from the existing building and not required for the completed renovation.** Owner to designate on-site location for storage of salvaged items for their use. Owner to transport salvaged items for

their retention to an off-site location as required. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items on site will not be permitted.
- C. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.
1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.
  2. Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.
  3. Protect floors with suitable coverings when necessary.
  4. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
  5. Remove protections at completion of work.
- D. Damages: Promptly repair damages caused to adjacent surfaces by demolition work.
- E. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
- F. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.
1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
- G. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 PREPARATION

- A. General: Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.
  1. Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.
  2. Cover and protect furniture, equipment, and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.
  3. Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

3.2 DEMOLITION

- A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.
  1. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.
  3. For interior concrete floor slabs, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.
- B. If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.3 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

1. Burning of removed materials is not permitted on project site.

#### 3.4 CLEANUP AND REPAIR

- A. General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.
  1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 02070

SECTION 04200  
UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201/CMA, "General Conditions of the Contract for Construction," 1992 Construction Manager-Advisor Edition, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section includes the following:
1. Concrete unit masonry (cmu).
  2. Mortar and Grout.
  3. Reinforcing steel and joint reinforcement.
  4. Ties, anchors, flashing and lintels related to masonry construction.
- B. Products installed but not furnished under this Section include the following:
1. Steel lintels in unit masonry are specified in Section 05500 "Metal Fabrications."
  2. Wood nailers and blocking built into unit masonry are specified in Section 06105 "Miscellaneous Carpentry."

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (f'm):
1. For concrete unit masonry: As follows:
    - a. f'm = 1500 psi.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

- B. Product data for each different masonry unit, accessory, and other manufactured product indicated.
- C. Samples for verification purposes of the following:
  - 1. Full-size units for each different exposed masonry unit required showing full range of exposed color, texture, and dimensions to be expected in completed construction.
  - 2. Colored masonry mortar samples for each color required showing the full range of colors expected in the finished construction. Label samples to indicate type and amount of colorant used.
  - 3. Accessories embedded in the masonry.
- D. Material certificates for the following signed by manufacturer and Contractor certifying that each material complies with requirements.
  - 1. Each different cement product required for mortar and grout including name of manufacturer, brand, type, and weight slips at time of delivery.
  - 2. Each material and grade indicated for reinforcing bars.
  - 3. Each type and size of joint reinforcement.
  - 4. Each type and size of anchors, ties, and metal accessories.
- E. Material test reports from a qualified independent testing laboratory employed and paid by Contractor indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
  - 1. Mortar complying with property requirements of ASTM C 270.
  - 2. Grout mixes. Include description of type and proportions of grout ingredients.
  - 3. Masonry units.
- F. Cold-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- G. Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
- H. Results from tests and inspections performed by Owner's representatives will be reported promptly and in writing to Architect and Contractor.

#### 1.5 QUALITY ASSURANCE

- A. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6 "Specifications for Masonry Structures," except as otherwise indicated.
  - 1. Revise ACI 530.1/ASCE 6 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9 and to modify Article 2.1.1.4 by deleting requirement for installing vent pipes and conduits built into masonry.
- B. Comply with ACI 530/ASCE5 "Building Code Requirements for Masonry Structures, Section 9.5 Lateral Support for bracing requirements of partitions.
- C. Fire Performance Characteristics: Where indicated, provide materials and construction identical to those of assemblies whose fire resistance has been determined per ASTM E 119 by a testing and inspecting organization, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.
- D. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.
- E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver masonry materials to project in undamaged condition.
- B. Store and handle masonry units off the ground, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not place until units are in an air-dried condition.
- C. Store cementitious materials off the ground, under cover and in dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- E. Store masonry accessories including metal items to prevent corrosion and accumulation of dirt and oil.



## 1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
  - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes from mortar droppings.
- C. Cold-weather Construction: Comply with referenced unit masonry standard for cold-weather construction and the following:
  - 1. Do not lay masonry units that are wet or frozen.
  - 2. Remove masonry damaged by freezing conditions.
- D. Hot-Weather Construction: Comply with referenced unit masonry standard.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Comply with referenced unit masonry standard and other requirements specified in this Section applicable to each material indicated.

### 2.2 CONCRETE MASONRY UNITS

- A. General: Comply with requirements indicated below applicable to each form of concrete masonry unit required.

1. Size: Provide concrete masonry units complying with requirements indicated below for size that are manufactured to specified face dimensions within tolerances specified in the applicable referenced ASTM specification for concrete masonry units.
  - a. Concrete Masonry Units: Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal lengths indicated on drawings.
  - b. Concrete Building Brick: Specified dimensions as follows:
    - 1) Standard Modular: 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
- B. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C 90-90, C145, and Grade N and as follows:
  1. Unit Compressive Strength: Provide units with minimum average net area compressive strength indicated below:
    - a. 1900 psi.
  2. Weight Classification: Lightweight.
  3. Aggregates: Lightweight, expanded shale, clay or slate produced by the rotary kiln method complying with ASTM C-331, and shall be graded (#4-0 Gradation) to assume constant texture. The blending of screenings or any other deleterious substance which will impair the fire rating or insulation values is prohibited.
  4. Units made with pumice or burn-off aggregates will not be accepted.
- C. Fire Rated Concrete Masonry Units: ASTM E 119, UL 618 and the American Insurance Association Specifications for the equivalent thickness for 2 hours or better, and meeting the requirements for concrete masonry units above.

### 2.3 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce required mortar color.
- B. Masonry Cement: ASTM C 91.

1. For colored pigmented mortars use premixed colored masonry cements of formulation required to produce color indicated, or if not indicated, as selected from manufacturer's standard formulations.
- C. Products: Subject to compliance with requirements, provide one of the following:
  1. Colored Masonry Cement:
    - a. "Colorbond Custom Color Masonry Cement," Centurion
    - b. "Atlas Custom Color Masonry Cement," Lehigh Portland Cement Co.
    - c. "Flamingo Color Masonry Cement," The Riverton Corporation.
  2. Varying mortar colors will be selected for each type of masonry utilized.

#### 2.4 REINFORCING STEEL

- A. General: Provide reinforcing steel complying with requirements of referenced unit masonry standard and this article.
- B. Steel Reinforcing Bars: Material and grade as follows:
  1. Grade 60.
- C. Deformed Reinforcing Wire: ASTM A 496.

#### 2.5 JOINT REINFORCEMENT

- A. General: Provide joint reinforcement complying with requirements of referenced unit masonry standard and this article, formed from the following:
  1. Galvanized carbon steel wire, ASTM-A153, Class B-2, hot-dipped,,1.5 oz. galvanized coating.
- B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with requirements indicated below:
  1. Wire Diameter for Side Rods: 0.1483 inch (9 gage).
  2. Wire Diameter for Cross Rods: 0.1483 inch (9 gage).

3. For single-wythe masonry provide type as follows with single pair of side rods:
  - a. Ladder design with continuous cross rods spaced not more than 16 inches o.c.
  - b. Subject to compliance with requirements, provide one of the following:
    - 1) "220 Ladder-Mesh", by Hohmann & Barnard, Inc., or equal.

## 2.6 TIES AND ANCHORS, GENERAL

- A. General: Provide ties and anchors specified in subsequent articles that comply with requirements for metal and size of referenced unit masonry standard and of this article.
- B. Galvanized Carbon Steel Wire: ASTM A 82, ASTM-A153, Class B-2, hot dipped, 1.5 oz. galvanized coating.
- C. Galvanized Steel Sheet: As follows:
  - a. Galvanized Steel Sheet: ASTM A 366 (commercial quality) cold-rolled carbon steel sheet, hot-dip galvanized after fabrication to comply with ASTM A 525, Class B2 (for unit lengths over 15 inches) and Class B3 (for unit lengths under 15 inches), for all sheet metal ties and anchors.

## 2.7 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO CONCRETE OR METAL STUD CONSTRUCTION

- A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and framework parallel to plane of wall, but resisting tension and compression forces perpendicular to it.
  1. Performance Characteristics: Capable of withstanding a 100 lb. force in either tension or compression without deforming over, or developing play in excess of, .05 inch.
- B. Screw-Attached Masonry Veneer Anchors: Units consisting of wire tie section and metal anchor section complying with the following requirements:
  1. Wire Tie Diameter: 3/16 inch
  2. Wire Tie Shape: Double Leg Pintle.

3. Wire Tie Length: 3 inch, 4 inch or 5 inch as required to extend 1-1/2 inches, but no closer than 1-1/4 inch from the outside face of masonry, into masonry wythe of veneer.
- C. Neoprene Gaskets: Screw-attached masonry veneer anchor manufacturer's standard closed cell neoprene gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating through screw holes.
- D. Products: Subject to compliance with requirements, provide the following:
  1. Screw-Attached Masonry Veneer Anchors:
    - a. D/A 213, type .5, 1, 1.5 or 2 Extra Heavy Duty," Dur-O-Wal, Inc.
    - b. D/A 5213, Dur-O-Wal, Inc.
  2. Provide powder-actuated fasteners, with a minimum working strength value of 100 lbs., driven through holes in the masonry veneer anchors, into the concrete, or metal stud.

2.8 ADJUSTABLE ANCHORS FOR CONNECTING MASONRY TO STRUCTURAL STEEL

- A. General: Two-piece assemblies as described below allowing vertical or horizontal differential movement between wall and structural steel parallel to plane of wall, but resisting tension and compression forces perpendicular to it.
  1. Performance Characteristics: Capable of withstanding a 100 lb. force in either tension or compression without deforming over, or developing play in excess of, .05 inch.
- B. For anchorage of masonry inner wythes to the face of steel columns, and to the underside of structural steel members, furnish to the structural steel fabricator continuous channel slots formed from 16 ga. (mill) galvanized sheet steel.
  1. Provide channel slot anchors formed from 3/16 inch diameter wire.
- C. Products: Subject to compliance with requirements, provide the following:
  1. Channel Slots:
    - a. D/A 904, Dur-O-Wal, Inc.

2. Triangle Tie Slot Anchors:
  - a. D/A 918-922, Dur-O-Wal, Inc.
- D. For the anchorage of masonry to the webs of steel beams at cavity wall conditions, furnish to the structural steel fabricator channel anchor slots formed from 16 gauge brite sheet steel, 8" long.
  1. Provide channel slot anchors formed from 16 gauge corrugated brite sheet metal, 3-1/2" long.
- E. Products: Subject to compliance with requirements, provide the following:
  1. Channel Slots:
    - a. D/A 901, Dur-O-Wal, Inc.
  2. Corrugated Channel Slot Anchors:
    - a. D/A 912, Dur-O-Wal, Inc.

2.9 ANCHORS FOR CONNECTING INTERIOR MASONRY PARTITIONS TO UNDERSIDE OF METAL DECKING AND JOINT STABILIZATION

- A. For anchorage of interior masonry partitions to the underside of metal decking or other structure above, and for joint stabilization assemblies at expansion, contraction or isolation joints. Spacing at 16 inches maximum centers.
- B. Products: Subject to compliance with requirements, provide the following:
  1. Joint Stabilization Anchors:
    - a. D/A 2200, Dur-O-Wal, Inc.

2.10 MISCELLANEOUS ANCHORS

- A. Provide 4 x 3 x 1/4 x 6 inch long steel clip angle anchors for laterally bracing masonry partitions to floor deck and underside of beams or girders above, arranged in pairs on each face of partition requiring bracing, spaced at 4' - 0" maximum centers.
  1. Provide these anchors in all locations where the length of a partition between lateral supports (buttresses, crosswalls, columns with ties), exceeds 36 times its thickness.

2. Provide these anchors in all partitions interrupted by control joints (except crosswalls).

## 2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Nonmetallic Control Joint and Brick Expansion Joint Strips: Premolded filler strips complying with ASTM D 1056, Type 2 (closed cell) , Class A (cellular rubber and rubber-like materials with specific resistance to petroleum base oils), Grade 1 (compression-deflection range of 2-5 psi), compressible up to 35 percent, of width and thickness indicated, formulated from the following material:
  1. Neoprene.
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Rapid Expansion Joint, D/A 2015", Dur-O-Wal, Inc.
    - b. "NS Closed Cell Neoprene Sponge", Hohmann and Barnard, Inc.
    - c. "032 Expansion Joint", National Wire Products Ind.
- C. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
- E. Wire Mesh Wall Ties: 2" x 2" x 16 gauge hot dipped galvanized wire for intersections of non-structural masonry walls.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "No. 269 Wire Mesh Wall Tie", Heckman Building Products, Inc.
- F. Mortar Net: Provide the following:
  1. High-density polyethylene in two inch thickness. Product to be 90% open weave mesh in a dovetail configuration connected by a continuous bottom strip.
  2. #MN 10-2, as manufactured by Mortar Net USA Ltd, or equal.

## 2.12 MORTAR AND GROUT MIXES

- A. General: Do not add admixtures including coloring pigments, air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
- B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification for job-mixed mortar and ASTM C 1142 for ready-mixed mortar, of types indicated below:
  1. For exterior, above-grade loadbearing and nonloadbearing walls and parapet walls, for reinforced masonry and where indicated, use type indicated below:
    - a. Type N.
  2. For interior loadbearing walls; for interior nonloadbearing partitions, and for other applications where another type is not indicated, use type indicated below:
    - a. Type N.
- C. Grout for Unit Masonry: Comply with ASTM C 476 and referenced unit masonry standard.
- D. **All mortar utilized for single wythe cmu wall construction shall contain The Dry Block Integral Water Repellant System by W.R. Grace & Co.**

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other specific conditions, and other conditions affecting performance of unit masonry.
- B. Examine rough-in and built-in construction to verify actual locations of piping connections prior to installation.
- C. Notify General Contractor and do not proceed until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Comply with referenced unit masonry standard and other requirements indicated applicable to each type of installation included in Project.



- B. Thickness: Build masonry construction to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness indicated.
- C. Leave openings for equipment to be installed before completion of masonry. After installation of equipment, complete masonry to match construction immediately adjacent to the opening.
- D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting where possible.

### 3.3 CONSTRUCTION TOLERANCES

- A. Comply with construction tolerances of referenced unit masonry standard.

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings, movement-type joints, returns, and offsets. Avoid the use of less-than-half-size units at corners, jambs, and where possible at other locations.
- B. Lay up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
  - 1. One-half running bond with vertical joint in each course centered on units in courses above and below.
- D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- E. Stopping and Resuming Work: In each course, rake back  $\frac{1}{2}$ -unit length for one-half running bond or  $\frac{1}{3}$ -unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly (if required), and remove loose masonry units and mortar prior to laying fresh masonry.

- F. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Fill in solidly with masonry around Specifications. built-in items.
  - 1. Fill space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
  - 2. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay solid brick masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
- B. Lay masonry units as follows:
  - 1. With full mortar coverage on horizontal and vertical face shells.
  - 2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
  - 3. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.
- C. Cut joints flush for masonry walls to be concealed or to be covered by other materials.
- D. Tool joints for masonry walls to be exposed in compliance with referenced masonry standard.
- E. Tool joints in block veneer as directed by the Construction Manager.

### 3.6 ANCHORING MASONRY TO STRUCTURAL MEMBERS

- A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:
  - 1. Provide an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials
  - 2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
  - 3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 32 inches o.c. horizontally.

### 3.7 MOVEMENT JOINTS

- A. General: Install control joints in unit masonry where indicated. Build in related items as the masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.
- B. Form control joints in concrete masonry as follows:
  - 1. Form open joint of not less than 3/8 inch and insert non metallic compressible joint filler in width equal to actual width of concrete masonry units, less 3/8 inch for installation of backer rod and sealant by Section 07920.
  - 2. Where backer rod and sealant will be installed on both sides of masonry units, install joint filler in width equal to actual width of unit masonry, less 3/4 inch.

### 3.8 LINTELS

- A. Install steel lintels where indicated, and wherever openings of more than 2 feet for block size units are shown. Provide minimum bearing of 5 inch at each jamb, unless otherwise indicated.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

### 3.9 FIELD QUALITY CONTROL

- A. Testing Frequency: Tests and evaluations listed in this article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
  - 1. Mortar properties will be tested per property specification of ASTM C 270.
  - 2. Mortar composition and properties will be evaluated per ASTM C 780.
  - 3. Grout compressive strength will be sampled and tested per ASTM C 1019.
- B. Evaluation of Quality Control Tests: In absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality control tests comply with minimum requirements indicated.

END OF SECTION 04200

SECTION 06105  
MISCELLANEOUS CARPENTRY

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section includes the following:
1. Rough carpentry work not specified elsewhere and generally intended for support of other work.
  2. Wood blocking for roofing and curbs
  3. Miscellaneous blocking, grounds, nailers, and panels.
  4. Installation of door hardware and doors within frames.
  5. Installation of equipment and/or accessories not specifically identified within the specifications.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 08710 "Door Hardware" for hardware furnished for installation under this Section.
  2. Section 09255 "Gypsum Board Assemblies" for metal-stud formed partitions, gypsum sheathing and aluminum control joint covers.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Wood treatment data from chemical treatment manufacturer. Include chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated material.
1. Preservative Treatment: Include certification by treatment plant stating type of solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
  2. Waterborne Preservative Treatment: Include certification that moisture content of treated wood was reduced to levels specified prior to shipment to Project site.

3. Warranty: Include warranty of chemical treatment manufacturer for each type of treatment.

#### 1.4 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 material above ground level on uniformly spaced supports to prevent deformation.
  1. For material pressure treated with waterborne chemicals, place spacers between each bundle for air circulation.

### PART 2 - PRODUCTS

#### 2.1 LUMBER, GENERAL

- A. Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Grade Stamps: Furnish lumber with each piece factory-marked with grade stamp of inspection agency that indicates grading agency, grade, species, moisture content at time of surfacing, and mill.
  1. For exposed lumber, furnish pieces marked on ends or back of each piece.
- C. Sizes: Provide nominal sizes indicated, complying with PS 20 except where actual sizes are specifically noted as being required.
- D. Surfacing: Dressed lumber, S4S, unless otherwise indicated.

#### 2.2 DIMENSION LUMBER FOR CONCEALED CONDITIONS

- A. Species: Same species as designated for exposed conditions.
- B. Moisture Content: Same moisture content as designated for exposed conditions.
- C. Grade: Same grade as designated for exposed conditions.

#### 2.3 DIMENSION LUMBER FOR EXPOSED CONDITIONS

- A. Species: Any one of the following:

1. Douglas fir.
2. Hem-fir.

B. Moisture Content: Kiln-dry, KD 15 or MC 15 (15 percent maximum moisture content).

C. Grade: No. 1 or construction grade.

#### 2.4 BOARDS FOR CONCEALED CONDITIONS

A. Species: Same species as listed for exposed boards.

B. Moisture Content: Same moisture content as designated for exposed boards.

C. Grade: Same grade as listed for exposed boards.

#### 2.5 BOARDS FOR EXPOSED CONDITIONS

A. Species: Any one of the following:

1. Douglas fir.
2. Hem-fir.

B. Moisture Content: Kiln-dry, KD 15 or MC 15 (15 percent maximum moisture content).

C. Grade: No. 1, 1 Common.

#### 2.6 CONSTRUCTION PANELS

A. Standards: Comply with requirements of PS 1 Voluntary Product Standard "Construction and Industrial Plywood" for veneer plywood and APA PRP-108 "Performance Standards and Policies for Structural-Use Panels" for performance-rated panels.

1. Trademark: Furnish construction panels that are each factory-marked with APA trademark for grade specified.

B. Miscellaneous Concealed Plywood: C-C Plugged Exterior, thickness as indicated but not less than 5/8 inch nominal.

#### 2.7 FASTENERS

- A. General: Where miscellaneous carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.
- B. Nails, Wire, Brads and Staples: FS FF-N-105.
- C. Wood Screws: ANSI B18.6.1.
- D. Bolts: ASTM A 307, Grade A; with ASTM A 563 hex nuts and flat washers.

## 2.8 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

- A. General: Obtain preservative-treated lumber complying with AWWA Standard C2. Mark each treated item with AWPB or SPIB Quality Mark Requirements. Coat surfaces cut after treatment to comply with AWWA M4.
- B. Above-Ground Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.25 pcf.
  - 1. Kiln-dry interior dimension lumber after treatment to 15 percent maximum moisture content.
  - 2. Kiln-dry interior construction panels after treatment to 15 percent maximum moisture content.
  - 3. Treat wood items indicated and in the following circumstances:
    - a. In contact with roofing, flashing, or waterproofing.
    - b. In contact with masonry or concrete.
    - c. Within 18 inches of grade.
- C. Ground-Contact Wood Treatment: Pressure treat with waterborne preservatives to a minimum retention of 0.40 pcf.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of miscellaneous carpentry and in sizes that would require an excessive number or poor arrangement of joints.
- B. Cut and fit miscellaneous carpentry accurately. Install members plumb and true to line and level.
- C. Coat cut edges of preservative-treated wood to comply with AWWA M4.

- D. Securely fasten miscellaneous carpentry as indicated and according to applicable codes and recognized standards.
- E. Countersink nail heads on exposed carpentry work and fill holes.
- F. Use fasteners of appropriate type and length. Pre-drill members when necessary to avoid splitting wood.

### 3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install where shown and where required for screeding or attachment of other work. Cut and shape to required size. Coordinate location with other work involved.
- B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.
- C. Provide wood blocking for all wall mounted or recessed equipment including, but not limited to, toilet accessories, telephone cabinet, visual display boards and wall mounted hardware.

### 3.3 DOOR HARDWARE INSTALLATION

- A. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Architect.
  - 1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
- B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.
- C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.



- E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers."
- F. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

END OF SECTION 06105

SECTION 07920  
JOINT SEALERS

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section includes joint sealants for the following locations:
1. Exterior joints in vertical surfaces and nontraffic horizontal surfaces as indicated below:
    - a. Control joints and expansion joints in unit masonry where exposed to view.
    - b. Perimeter joints between unit masonry and frames of doors, windows, and louvers.
    - c. Control and expansion joints in soffits and overhead surfaces.
    - d. Other joints as indicated.
  2. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Control joints in ceilings and overhead surfaces.
    - c. Perimeter joints of exterior openings.
    - d. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    - e. Perimeter joints of toilet fixtures
    - f. Perimeter joints of detention cell bunks, detention equipment and penalware.
    - g. All exposed joints between steel columns, masonry, drywall, or other dissimilar materials.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 05800 "Expansion Control" for building expansion and seismic control.
  2. Section 07270 "Firestopping" for fire-resistance-rated joint sealants.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

#### 1.4 SUBMITTALS

- A. Product data from manufacturers for each joint sealant product required.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

#### 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 period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Notify Architect and do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
  - 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4.4 deg C).
  - 3. When joint substrates are wet.

- B. Joint Width Conditions: Notify Architect and do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Notify Architect and do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

## 1.8 SEQUENCING AND SCHEDULING

- A. Sequence installation of joint sealants to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, joint fillers, 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: Provide color of exposed joint sealants to comply with the following:
  - 1. Provide selections made by Architect from manufacturer's full range of standard colors for products of types indicated.

### 2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with those requirements referencing ASTM 920 classifications for Type, Grade, Class, and Uses.
- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Multi-Part, Non Sag Urethane Sealants:
    - a. "Dynatrol II", Pecora Corp.
    - b. "Sonolastic NP2", Sonneborn Building Products Division
    - c. "Dymeric Plus", Tremco.
  - 2. Multi-Part, Self Levelling Urethane Sealant:
    - a. "Sikaflex - 20 SL", Sika Corp.
    - b. "Sonolastic SL2", Sonneborn Building Products Division.

### 2.3 LATEX JOINT SEALANTS

- A. General: Provide manufacturer's standard one-part, nonsag, mildew-resistant, paintable latex sealant of formulation indicated that is recommended for exposed applications on interior and protected exterior locations and that accommodates indicated percentage change in joint width existing at time of installation without failing either adhesively or cohesively.
- B. Acrylic-Emulsion Sealant: Provide product complying with ASTM C 834 that accommodates joint movement of not more than 5 percent in both extension and compression for a total of 10 percent.
- C. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Acrylic-Emulsion Sealant:
    - a. "AC-20", Pecora Corp.
    - b. "Sonolac," Sonneborn Building Products Div., ChemRex, Inc.
    - c. "Tremco Acrylic Latex 834, " Tremco, Inc.

### 2.4 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. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Open-cell polyurethane foam.
  - 2. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
  - 3. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf and tensile strength of 35 psi per ASTM D 1623, and with water absorption less than 0.02 gms/cc per ASTM C 1083.
  - 4. Any material indicated above.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape as 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.

## 2.5 SECURITY SEALANTS

- A. General: Provide manufacturer's standard rigid, two-part, high solids, high modulus epoxy resin compound that is recommended for high security areas of prisons and other security areas and that provides high abrasion resistance and "pick-proof" properties.
- B. Epoxy Resin Sealant: Provide product complying with ASTM C 881, Type I.
- C. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Epoxy Resin Sealant:
    - a. "DynaPoxy EP-1200", Pecora Corp.

## 2.6 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 in any way joint substrates and adjacent nonporous surfaces, 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. Notify Architect and do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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 concrete, masonry, unglazed surfaces of ceramic tile, and similar 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 metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other 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 indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. 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 printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
  
- B. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
    - a. Do not leave gaps between ends of joint fillers.
    - b. Do not stretch, twist, puncture, or tear joint fillers.
    - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
  2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- C. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- D. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
1. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

### 3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved 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 or from damage resulting from construction operations or other causes so that they 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 that and installations with repaired areas are indistinguishable from original work.



### 3.6 GUARANTEE AND CERTIFICATION

- A. This Contractor shall guarantee **in writing** that all sealant work will be free from defects of materials and workmanship for a period of five (5) years. The following types of failure will be adjusted:
1. Leakage, cracking, crumbling, melting, shrinking or running of caulking, or staining of adjacent work by caulking.
- B. This Contractor shall repair and replace work which becomes defective during guarantee term without cost to the Owner.

### 3.7 SCHEDULE

- A. Exterior Joints:
1. Masonry to masonry: Multi-Part, Non-Sag Urethane Sealant.
  2. Masonry to door frames: Multi-Part, Non-Sag Urethane Sealant
  3. All expansion and control joints: Multi-Part, Non-Sag Urethane Sealant
  4. Metal frame and louver perimeters: Multi-Part, Non-Sag Urethane Sealant
  5. All exposed joints between dissimilar materials: MultiPart, Non-Sag Urethane Sealant
- B. Interior Joints
1. Masonry to door frames: Acrylic-Emulsion Sealant
  2. Masonry or drywall to window frames: Acrylic-Emulsion Sealant
  3. Masonry to drywall: Acrylic-Emulsion Sealant
  4. All expansion and control joints: Acrylic-Emulsion Sealant
  5. Steel frame and louver perimeters: Acrylic-Emulsion Sealant
  6. Plumbing fixtures: Acrylic-emulsion Mildew-Resistant Sealant
  7. Detention cell / cell bunks / detention fixtures: Epoxy Resin Sealant (apply only after painting)
  8. All exposed joints between steel columns and masonry, drywall or other dissimilar materials: Urethane Sealant or Acrylic-Emulsion Sealant if in contact with epoxy paint.

END OF SECTION 07920



SECTION 09900  
PAINTING

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 WORK INCLUDED

- A. This Section includes surface preparation, all necessary materials and painting for all interior surfaces in new construction where so specified. The extent of painting work is shown on Drawings/ Schedules. Work shall include: latex wall and High performance Ceiling paint –**Eminence** by Sherwin-Williams (A27W3815), gypsum board wall, masonry walls, steel doors and frames – Pro Industrial Multi-surface Acrylic
- B. Manufacturer's products and colors shall be as noted in Drawings/ Schedules as shown and specified.
- C. Related Sections: The following sections contain requirements that relate to this section:
1. Division 4 for painting of Unit Masonry.
  2. Division 5 for painting of Metal Fabrications.
  3. Division 8 for painting of Steel Doors and Frames.

1.3 WORK NOT INCLUDED

- A. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper and similar finished materials will not require painting under this Section, unless so noted.
- B. Do not paint the moving parts of operating units, mechanical or electrical parts such as valve operators, linkages, sensing devices and motor shafts.
- C. Do not paint over required labels or equipment identification, performance rating name or nomenclature plates.
- D. Painting not required for shop finished millwork items.
- E. Do not paint ceramic tile or similar finished materials.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
  - 1. Materials data sheet for each type of product specified.
  - 2. Samples for verification purposes of each type of exposed finish required, prepared on samples of size indicated below. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected. Provide 3 sets of samples.
    - a. 8"x10" samples of each paint color.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has successfully completed painting projects similar in material, design, and extent to those indicated for Project. Installer shall thoroughly review Contract Documents and be familiar with structure and all necessary requirements for attachment to same.
- B. Fire-Performance Characteristics: Conform to Building Code for Flame Rating Requirement for finishes.
- E. Coordination of Work: Coordinate work with other construction.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint materials and floor system materials to project site in original, labeled, unopened packages and store them in a fully enclosed space where they will be protected against damage. Labeling to include manufacturer's name, type of paint, brand name, color designation, drying time, clean up and instructions for mixing and use.
- B. Store paint materials and floor system materials at a minimum ambient temperature of 45 degrees F and a maximum ambient temperature of 90 degrees F in a well-ventilated area, unless otherwise directed by manufacturer's instructions.
- C. Take precautionary measures to prevent fire hazards and spontaneous combustion.

#### 1.7 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating of space to maintain surface and ambient temperature above 65 degrees F for 24 hours before, during and 48 hours after application of finishes, unless otherwise indicated by manufacturer or specifications herein.
- B. Provide lighting level of 80 foot-candles measured mid-height at substrate surface.

## 1.8 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.
  - 1. Minimum of one quart of each finish specified. Labeling shall include manufacturer, type, color name and number.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS:

- A. Acceptable Manufacturers:
  - 1. The Sherwin Williams Company
  - 2. Benjamin Moore and Company
  - 3. Pittsburgh Paints

### 2.2 MATERIALS- GENERAL

- A. Provide products which will meet all Federal regulations for amount of lead in paint (Less than 0.06% lead in non-volatile ingredients).
- B. Coatings: Provide best quality grade of various types of coatings. Materials not displaying manufacturer's identification as a standard, best-grade product will not be accepted.
- C. Use only thinners approved by paint manufacturers for applications intended and use only within recommended limits.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and verify that conditions are ready to receive work as instructed by the product manufacturer.
- B. Beginning of installation means acceptance of substrate.

### 3.2 PREPARATION:

- A. Remove electrical plates, hardware, light fixture trim and fitting prior to preparing finishes for painting.
- B. Correct minor defects and clean surfaces which may affect the work of this section.
- C. Shellac and seal marks that may bleed through surface finishes.
- D. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.
- E. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- F. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove loose dirt, loose mortar, scale, salt, or alkali powder or other foreign matter. Remove oil or grease with a solution of trisodium phosphate. Rinse well and allow to dry.
- G. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt and rust. Where heavy coatings of scale are evident, remove by wire brushing. Clean with solvent. Spot prime paint after repairs.
- H. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
- I. Interior Wood Items (Painted): Wipe off dust and grit prior to priming. Seal knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- J. Interior Wood Items (Clear Finished): 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. Fill nail holes. Sand smooth and sand lightly between coats.
- K. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer. Seal wood door edges after trimming to prevent absorption of moisture.

### 3.3 PROTECTION

- A. Protect elements surrounding the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Furnish drop cloths, shields and protective methods to prevent spray or droppings from other surfaces.
- D. Remove all empty paint containers from site.

### 3.4 APPLICATION:

- A. Apply all products in accordance with manufacturer's instructions.
- B. No work shall be performed in spaces that are not broom clean and free of dust and waste.
- C. Apply each coat to a uniform finish, free of brush or roller marks, drops, runs or sags.
- D. Sand lightly between coats to achieve required finish.
- E. Allow applied coat to dry before next coat is applied. Allow a minimum of 48 hours for enamel paints to dry before recoating.
- F. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- G. Prime back surfaces of interior woodwork scheduled to receive stain or varnish with gloss varnish reduced to 24 percent with mineral spirits with primer paint.
- H. Finish doors on tops, bottoms and side edges same as exterior faces.
- I. As work proceeds, promptly remove paint where spilled, splashed or spattered.
- J. Collect cloths and materials which may constitute a fire hazard, place in a closed metal container and remove daily from site.

### 3.5 CLEANING

- A. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.6 SCHEDULE-INTERIOR SURFACES

- 1. All surface except for ceiling to be painted with self priming Multi-Surface Acrylic by Sherwin- Williams or approved other

END OF SECTION 09900- PAINTING



SECTION 10155  
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section includes stock, manufactured toilet compartments.
- B. Types of toilet partitions include:
  - 1. Plastic toilet compartment partitions for following applications:
    - a. Toilet enclosure
    - b. Urinal screens
- C. Style of Toilet Compartment, include:
  - 1. Floor mounted, overhead braced.
- D. Toilet accessories, such as toilet paper holders and grab bars are specified in Section 10800 "Toilet Accessories".
- E. Related Requirements:
  - 1. Division 03 Section "Cast in Place Concrete" for compartment anchorage to concrete substrates.
  - 2. Division 04 Section "Unit Masonry" for compartment anchorage to masonry substrates.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for materials, fabrication, and installation including catalog cuts of anchors, hardware, fastenings, and accessories.
- C. Shop drawings for fabrication and erection of toilet compartment assemblies not fully described by product drawings, templates, and instructions for installation of anchorage devices built into other work.

- D. Samples of full range of colors for each type of unit required. Submit 6-inch-square samples of each color and finish on same substrate to be used in work, for color verification after selections have been made.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance and cleaning instructions.

#### 1.4 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of work. However, allow for adjustments where taking of field measurements before fabrication might delay work.
- B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet compartments and related items. Coordinate delivery with other work to avoid delay.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
  - 1. Plastic toilet compartment partitions:
    - a. American Sanitary Partition Corp.
    - b. Bobrick Washroom Equip, Inc.
    - c. Bradley Corporation, The Mills Company

#### 2.2 MATERIALS

- A. General: Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

- B. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface, Class C
- C. Hardware and Accessories: Heavy duty operating hardware and accessories of ASTM 162, Type 302/304 Stainless Steel, #4 satin finish.
- D. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass, finished to match hardware, with theft-resistant-type heads and nuts. For concealed anchors, use stainless steel.
- E. Fire resistance characteristics per ASTM E-84 Tests: flame spread of 0-25 max. smoke density 100 max.
- F. General: Furnish doors, fabricated for compartment system. Furnish units with cutouts, drilled holes, and internal reinforcement to receive hardware and accessories as indicated.
- G. Door Dimensions: Unless otherwise indicated, furnish 24-inch-wide in-swinging doors for ordinary toilet stalls and 32-inch-wide (clear opening) out-swinging doors for stalls equipped for use by handicapped.
- H. Hardware: Furnish hardware for each compartment to comply with ANSI A117.1 and U.S. ADA Guidelines for handicapped accessibility and as follows:
  - 1. Hinges: Continuous hinge full height of door. Type 304 satin finish stainless steel; extra heavy duty 16 gauge. Through bolted to door and stile with 12 theft-resistant, one way screws fastened into threaded metal inserts.
  - 2. Latch and Keeper: Door latch with shock resistant nylon track into 1 inch wide keeper formed from one piece 1/8 inch 11 gauge stainless steel. Keeper shall be through bolted to stile with theft resistant one-way screws fastened into threaded metal inserts. Vinyl coated door stops.
  - 3. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.
  - 4. Door Pull: Manufacturer's standard unit for out-swinging doors. Provide pulls on both faces of handicapped compartment doors.
  - 5. Pilaster Shoes: ASTM A 167, Type 304 stainless steel not less than 4 inches high, finished to match hardware.
  - 6. Overhead bracing: Continuous stainless steel at all sides and subdivisions.

## 2.3 FINISH

- A. Color: One of manufacturer's standard colors in each room, as selected by Architect.

### PART 3 - EXECUTION

#### 3.1 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of toilet compartments.
- B. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum 5 years experience in the manufacture of toilet compartments. Manufacturers seeking approval must submit the following in accordance with Instructions to Bidders and Division 01 requirements:
  - 1. Product data, including test data from qualified independent testing agency indicating compliance with requirements.
  - 2. Samples of each component of product specified.
  - 3. List of successful installations of similar products available for evaluation by Architect.
- C. Installers Qualifications: Experienced Installer regularly engaged in installation of toilet compartments for minimum 3 years.
- D. Source Limitations: Obtain toilet compartment components and accessories from single manufacturer.

#### 3.2 WARRANTY

- A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:
  - 1. Plastic Toilet Partitions: Against corrosion, breakage, and delamination: 15 years.

#### 3.3 INSTALLATION

- A. General: Comply with manufacturer's recommended procedures and installation sequence. Install compartment units rigid, straight, plumb, and

level. Provide clearances of not more than 1/2 inch between pilasters and panels, and not more than 1 inch between panels and walls.

3.4 ADJUST AND CLEAN

- A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.
  
- B. Clean exposed surfaces of partition system components using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION 10155

SECTION 10200  
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section includes the following:
1. Fixed metal, storm resistant wall louvers.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Section 07901 "Joint Sealants" for sealants installed in perimeter joints between louver frames and adjoining construction.
  2. Division 15 Section for ductwork connected to metal wall louvers.

1.3 DEFINITIONS

- A. Louver Terminology: Refer to Air Movement and Control Association (AMCA) 501 for definitions of terms for metal louvers not otherwise defined in this Section or in referenced standards.

1.4 PERFORMANCE REQUIREMENTS

- A. As follows, determined by testing on a (1) meter wide by one (1) meter high per BSRIA. The louver manufacturer shall submit certified test data. The louver tested shall be with a rain fall rate of 3 inches per hour and a wind directed at the face of the louver of 29.1 mph. The test data will show that at a ventilation rate of 8224 cfm: Louver effectiveness = 100%.

1.5 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 product specified.

- C. Shop drawings of louver units and accessories. Include plans, elevations, sections, and details showing profiles, angles, and spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; profiles of frames at jambs, heads, and sills; and anchorage details and locations.
- D. Samples for initial selection in the form of manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
- E. Product test reports evidencing compliance of units with performance requirements indicated.
- F. Product certificates signed by louver manufacturers certifying that their products comply with the specified requirements and are licensed to bear the AMCA seal based on tests made according to AMCA 500 and complying with the AMCA Certified Ratings Program.
- G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.

#### 1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain louvers and vents from one source and by a single manufacturer where alike in one or more respects regarding type, design, and factory-applied color finish.
- B. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating louvers without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Louvers:
    - a. Airstream Products Div., Penn Ventilator Co., Inc.
    - b. Construction Specialties, Inc.
    - c. Ruskin Mfg., Tomkins Industries, Inc.
- B. For the purpose of establishing performance criteria the Contract Drawings and specifications have been based on Construction Specialties, Inc., Model RS-8400.

## 2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM 3 221M) . Alloy 6063-T5 or T-52.
- B. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.
  - 1. Use types and sizes to suit unit installation conditions.
  - 2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
- C. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

## 2.3 FABRICATION, GENERAL

- A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.
- B. Assemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.



- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide sill extensions and loose sills made of same material as louvers where indicated or required for drainage to exterior and to prevent water penetrating to interior.
- G. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary:
  - 1. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

#### 2.4 FIXED, EXTRUDED-ALUMINUM WALL LOUVERS

- A. Fixed, Extruded-aluminum wall louvers, horizontal, Storm resistant Fixed Blade Louver designed to collect and drain water to exterior at sill by means of multiple gutters in blades and channels in jambs and mullions, complying with the following requirements:
  - 1. Louver Depth: 8 inches
  - 2. Frame Type: Channel type, unless otherwise indicated.
  - 3. Frame Thickness: 0.081 inch
  - 4. Blade Thickness: 0.0674 inch
- B. Subject to compliance with requirements, provide by the following:
  - 1. Construction Specialties, Inc.
- C. Provide sill flashing pans 4 inches high by full depth formed from minimum .050 inch thick aluminum. Sill pan to have welded side panels.

#### 2.5 LOUVER SCREENS

- A. General: Provide each exterior louver with louver screens complying with the following requirements:
  - 1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.
  - 2. Screening Type: Insect screening and Bird screening.
- B. Secure screens to louver frames with stainless-steel machine screws, spaced 6 inches (150 mm) maximum from each corner and at 12 inches (300 mm) o.c. between.

- C. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:
  - 1. Metal: Same kind and form of metal as indicated for louver frames to which screens are attached.
    - a. Reinforce extruded-aluminum screen frames at corners with clips.
  - 2. Finish: Mill finish, unless otherwise indicated.
  - 3. Type: Rewireable frames with a driven spline or insert for securing screen mesh.
  
- D. Louver Screening for Aluminum Louvers: Fit aluminum louver screen frames with screening covering louver openings and complying with the following requirements:
  - 1. Bird Screening: 1/2-inch- (12.7-mm-) square mesh formed with 0.063-inch- (1.60-mm-) diameter aluminum wire.
  - 2. Insect Screening: 18-by-16 (1.4-by-1.6-mm) mesh formed with 0.012-inch- (0.30-mm-) diameter aluminum wire.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Finish louvers after assembly.

## 2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Coating Finish: AA-CI2C42RIx (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
  - 1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

- a. Color and Gloss: As selected by Architect from manufacturer's full range of standard choices for color and gloss.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages. Coordinate delivery of such items to Project site.

#### 3.2 INSTALLATION

- A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.
- F. Protect nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

#### 3.3 ADJUSTING AND PROTECTION

- A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.

- B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Architect, remove damaged units and replace with new units.
  - 1. Clean and touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

### 3.4 CLEANING

- A. Periodically clean exposed surfaces of louvers and vents that are not protected by temporary covering to remove fingerprints and soil during construction period. Do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Rinse surfaces thoroughly and dry.

END OF SECTION 10200

SECTION 10800  
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Instructions to Bidders, AIA Document A201, "The General Conditions of the Contract for Construction," 15th Edition, 1997, the Supplementary General Conditions and Division 1, General Requirements, are a part of this Section and shall be binding on the Contractor and/or Subcontractor who performs this work. Note also all Addenda.

1.2 SUMMARY

- A. This Section includes furnishing toilet and bath accessory items as shown on the drawings and as specified herein.
- B. Installation of toilet and bath accessories is specified in Section 06105, "Miscellaneous Carpentry".
- C. Installation of wood blocking is specified in Section 06105, "Miscellaneous Carpentry".
- D. Toilet compartments and related accessories are specified in Section 10155, "Toilet Compartments"
- E. Division 04 Section "Unit Masonry" for anchorage to masonry substrates.

1.3 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specifications Sections.
- B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.
- C. Schedule indicating types, quantities, sizes, and installation locations (by room) for each toilet accessory item to be provided for project.
- D. Setting drawings where cutouts are required in other work, including templates, substrate preparation instructions, and directions for preparing cutouts and installing anchorage devices.
- E. Maintenance instructions including replaceable parts and service recommendations.

#### 1.4 QUALITY ASSURANCE

- A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.
- B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.
- C. Catalog Standards: Manufacturer's catalog numbers may be shown on drawings for convenience in identifying certain work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each item.
  - 1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of any other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction, and workmanship.
  - 2. The approval of other listed manufacturers, products does not relieve the Contractor from compliance with the detailed requirements of this Section.

#### 1.5 PROJECT CONDITIONS

- A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

#### 1.6 WARRANTY

- A. Warranty: Submit a written warranty executed by mirror manufacturer, agreeing to replace any mirrors that develop visible silver spoilage defects within warranty period.
- B. Warranty Period: 15 years from date of Substantial Completion.
- C. The warranty shall not deprive the Owner of other rights the owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide toilet accessories by one of the following:
  - 1. American Specialties, Inc. (ASI)
  - 2. Bobrick Washroom Equipment, Inc. (Bobrick), or equal.

### 2.2 MATERIALS, GENERAL

- A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.
- B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
- C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 527, G60.
- E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
- F. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
- G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

### 2.3 TOILET TISSUE DISPENSERS (T.P.D.)

- A. Stainless Steel Twin Jumbo Roll Toilet Tissue Dispenser:
  - 1. Mounting: Surface mounted, concealed anchorage.
  - 2. Cabinet: 18-8 S. type 304, 20 gauge stainless steel with satin finish. Equipped with a tumbler lock keyed like other toilet accessories.
  - 3. Capacity: Spindles accommodate two toilet tissue rolls up to 10" diameter with 3" diameter core, or remove outer spindle from the inner spindles to accommodate 2 ¼" diameter core rolls.
  - 4. Subject to conformance with requirements, provide "Model B-2892, Bobrick.

2.6 GRAB BARS (G.B.)

- A. Stainless Steel Type: Provide grab bars with wall thickness not less than 0.05 inch (18 gage) and as follows:
1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
  2. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
  3. Gripping Surfaces: Manufacturer's standard nonslip texture.
  4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.
  5. Subject to conformance with requirements, provide grab bar units manufactured by Bobrick Washroom Equipment, Inc.:
    - a. "Model B-6806x36", for rear wall installation
    - b. "Model B-6806x42", for side wall installation
    - c. "Model B-6806 x18", for side wall vertical installation
    - d. "Model B-6897", for side and rear wall shower installation

2.7 ROBE HOOKS (R.H.)

- A. Single-Prong Single Robe Hook: Heavy-duty satin finished stainless steel single-prong robe hook; rectangular wall bracket with backplate for concealed mounting.
1. Subject to conformance with requirements, provide "Model B-2116", Bobrick.

2.8 SOAP DISPENSERS (S.D.)

- A. Wall Mounted:
1. Surface mounted soap dispenser for liquid and lotion soaps and detergents.
  2. Capacity: 40 fluid ounces.
  3. Construction: 18-8 S, type 304, 22 gauge stainless steel with satin finish. Body is drawn, one-piece seamless construction. Back plate has mounting bracket attached. Furnished with concealed wall plate.

2.9 MIRRORS (M.W.F.)

- A. Wall Mounted Mirrors with Frames:
1. Subject to conformance with requirements, provide "Model B-166-1830", BOBRICK.



## 2.9 BABY CHANGING STATION (B.C.S.)

- A. Wall Mounted:
  - 1. Subject to conformance with requirements, provide "Model KB200-01", KOALA KARE.
  - 2. Quantity: Provide one (1) unit for Male Bathroom, one (1) unit for Female Bathroom.

## 1.10 ELECTRIC HAND DRYER (E.H.D.)

- A. Wall Mounted:
  - 1. Subject to conformance with requirements, provide "Model XLERATOR BMC XL-BW", EXCEL DRYER INC..
  - 2. Quantity: Provide one (1) unit for Male Bathroom, one (1) unit for Female Bathroom.

## 2.14 FABRICATION

- A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. on either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight welded seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.
- C. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
  - 1. Provide galvanized-steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with non absorptive filler material. Corrugated cardboard is not an acceptable filler material.
- D. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:
  - 1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

- E. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install toilet accessory units according to manufacturers, instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.
  - 1. Reinforcement of stud walls to support wall-mounted cabinets will be accomplished during wall erection by trade involved; however, indicating accurate location and sizing of reinforcement is responsibility of toilet and bath accessories installer.
  - 2. Install toilet accessory units furnished by the owner using fasteners appropriate to substrate as required.
- B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.
- C. Install grab bars to withstand a downward load of at least 250 lbs, complying with ASTM F 446.

#### 3.2 ADJUSTING AND CLEANING

- A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
- B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10800

SECTION 15010  
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions apply to this section.

1.2 DESCRIPTION

- A. General: Materials and methods for performance of mechanical work related to HVAC systems installation.
- B. Provide complete and operational mechanical systems including, but not limited to, all required materials, parts, equipment, labor, tools, and accessories.

1.3 SUMMARY

- A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included.
  - 1. Codes & standards.
  - 2. Submittals.
  - 3. Quality control.
  - 4. Permits, fees, and inspections.
  - 5. Schedule and sequence.
  - 6. Project and site conditions.
  - 7. Delivery, storage, and handling.
  - 8. Coordination drawings.
  - 9. Record documents.
  - 10. Maintenance manuals.
  - 11. Warranties and guaranties.
  - 12. Rough-ins.
  - 13. Mechanical installations.
  - 14. Cutting and patching.
  - 15. Firestopping
  - 16. Mechanical identification.
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 2 through 14 all sections

2. Division 16 - all sections.

1.4 CODES AND STANDARDS

- A. Except as modified by governing codes, comply with applicable provisions and recommendations of the following:
1. ANSI Standards.
  2. Owner's Insurance Company.
  3. All applicable federal, state and local laws and statutes.

1.5 SUBMITTALS

- A. Shop Drawings:
1. Submit for review, detailed shop drawings of all the equipment and material required to complete the work. No material or equipment may be delivered to the jobsite or installed until accepted shop drawings for the particular material or equipment have been approved by the Owner or his authorized representative.
  2. Submit shop drawings in accordance with the requirements outlined in the General Conditions.
  3. Failure to submit shop drawings in ample time for checking will not entitle Contractor to Contract time, or increase in contract cost.

1.6 QUALITY ASSURANCE

- A. Drawings:
1. Drawings are diagrammatic. They indicate the general arrangement of systems and work included in the contract. Drawings are not to be scaled. Original architectural drawings and details shall be examined for exact location of fixtures and equipment. When drawing are not available or where they are not definitely located, this information shall be obtained from the Owner or authorized representative.
  2. Surveys and Measurements:
    - a. Before submitting bid, visit site, become familiar with conditions under which work will be installed. Contractor will be held responsible for assumptions, omissions, and errors made as a result of failure to become familiar with site and contract documents.
    - b. Base all measurements, both horizontal and vertical, from established benchmarks. All work shall agree with established lines and levels. Verify all measurements at site

and check the correctness of same.

- c. Notify the Engineer promptly of discrepancies between actual measurements and those indicated, which prevents following good practice or intent of drawings and specifications. Do not proceed with work until Contractor has received instructions from Engineer.

B. Labor:

1. Cooperation with Other Trades:

- a. Give full cooperation to other trades; furnish in writing to Contractor, with copies to the Owner, information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- b. Where work will be installed in close proximity to, or will interfere with work of other trades, assist in working out space conditions to make a satisfactory adjustment. If directed by the Owner, prepare composite working drawings and sections at a suitable scale not less than  $1/4" = 1'0"$ , clearly showing how work is to be installed in relation to the work of other trades. If work under this division is installed before coordinating with other trades, or to cause any interference with work of other trades, make necessary changes to correct the condition without additional cost.
- c. Furnish to other trades all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

2. Materials & Workmanship:

- a. Materials and apparatus required for the work shall be new and of first class quality. Furnished, delivered, erected, connected and finished in every detail. Select and arrange to fit properly into the building spaces. Where no specific kind or quality of material is given, furnish first class standard article as accepted by Owner.
- b. Furnish the services of an experienced superintendent who shall be in constant charge of the work, together with skilled craftsmen and labor required to unload, transfer, erect, connect-up, adjust, start, operate, and test each system.

- c. All equipment and materials to be installed with the acceptance of the Owner or his authorized representative in accordance with the recommendations of the manufacturer. This includes the performance of such test as the manufacturer recommends.
3. Protection of Materials:
- a. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
  - b. Welding: Before any welding is performed, submit a copy of the Welding Procedure Specification (WPS) together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code.
    - 1. Before any welder performs any welding, submit a copy of the Manufacturer's Record of Welder or Welding Operator Qualification Tests as required by Section IX of the ASME Boiler and Pressure Vessel Code. The letter or symbol (as shown on the qualification test form) shall be used to identify the work of that welder and shall be affixed, in accordance with appropriate construction code, to each completed weld.
    - 2. The types and extent of non-destructive examinations required for pipe welds are shown in Table 136.4 of the Code for Pressure Piping, ASNI/ASME B31.1.
  - c. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Engineer prior to the installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

## 1.7 PERMITS, FEES, & INSPECTIONS

- A. Give all necessary notices, obtain all permits, and pay all government sales taxes, fees, and other costs, including utility connections or extensions in connection with work. File necessary approvals of governmental departments having jurisdiction. Obtain required certificates

of inspection for work and deliver a copy to the Owner or his authorized representative before requesting acceptance for final payment.

## 1.8 SCHEDULE & SEQUENCE

### A. Temporary Shutdowns:

1. Installation of new systems requiring the temporary shutdown of an existing operating system, the connection of the new system to be performed at such time as designated by the owner or authorized representative.
2. Notify the Owner of the estimated duration of the shutdown as noted elsewhere.
3. Arrange work for continuous performance, including authorized overtime if required, to assure existing operating services will be shut down only during the time actually required to make connections.

### B. Temporary Services:

1. Refer to the General Conditions and Special Conditions for a full description of the temporary services to be provided.

### C. Temporary Openings:

1. Ascertain from examination of the drawings any special temporary openings in the building required for the admission of apparatus provided under this Division. Notify the Owner accordingly. In the event of failure to give sufficient notice to the Contractor in time to arrange for openings during construction, assume all costs of providing such openings thereafter.

### D. Sequencing:

1. Coordinate sequence of work with General Contractor.

## 1.9 PROJECT & SITE CONDITIONS

### A. Cutting and Patching:

1. Furnish all cutting and patching. Furnish sketches showing the locations and sizes of openings, chases, etc., required for the installation of work. Furnish the Contractor with an approximation

of the number of openings, chases, etc., required.

B. Waterproofing:

1. Where a work pierces existing waterproofing, re-waterproof. The method of installation to be reviewed by Owner or his authorized representative before work is done. Furnish all sleeves, caulking, and flashing required to make openings watertight.

1.10 DELIVERY, STORAGE, & HANDLING

A. Delivery & Receipt:

1. Contractor is responsible for the delivery and storage of all materials, parts, equipment, etc. required for this project.

B. Storage:

1. The Contractor shall store all material, parts, and equipment required for this project in accordance with supplier's and manufacturer's recommendations, and Owner's requirements.

C. Handling, Hoisting, Rigging, & Scaffolding:

1. Furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished under this Division. Remove same from premises when no longer required.

1.11 RECORD DOCUMENTS

- A. Maintain at the job site a record set of drawings on which any changes in location of equipment, piping, ducts, valves, cleanouts, panels, and major conduits shall be recorded. These shall be clearly marked on a clean set of prints at the completion of work for record drawings and turned over to the Owner.

1.12 OPERATION & MAINTENANCE MANUALS FOR MECHANICAL SYSTEMS

- A. Bind Operation & Maintenance Manual for Mechanical System in a hard-backed binder. Spine of each binder shall have the following lettering done in silkscreen:

OPERATION AND MAINTENANCE MANUAL  
BATHROOM RENOVATIONS AT VARIOUS PARKS, CHESHIRE, CT



1. Provide a master index at beginning of Manual showing items included. Use plastic tab indexes for sections of Manual.
  2. First section shall consist of name, address, and phone number of Mechanical & Electrical Engineers, General Contractor and Mechanical, Plumbing, Sheet Metal, Refrigeration, Temperature Control & Electrical Contractors. Also include a complete list of equipment installed with name, address, and phone number of vendor.
  3. Provide section for each type of item of equipment.
  4. Submit three copies of Operation & Maintenance Manual to Engineer for his approval. Use one of these approved copies during final inspection and leave with building custodian.
- B. Include descriptive literature (Manufacturer's catalog data) of each manufactured item. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
- C. Operating instructions shall include:
1. General description of each mechanical system.
  2. Step by step procedure to follow in putting each piece of mechanical equipment into operation.
  3. Provide schematic control diagrams for each separate fan system, cooling system, heating system, control panel, etc. Each diagram shall show locations of start-stop switches, insertion thermostats, room thermostats, thermometers, firestats, pressure gauges, automatic valves, and refrigeration accessories. Mark correct operating setting for each control instrument on these diagrams.
  4. Provide diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlock, electrical switches, and relays.
  5. Provide drawing of each temperature control panel identifying components on the panels and their functions.
- D. Maintenance instructions shall include:
1. Manufacturer's maintenance equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers & lists, operation instructions of equipment and maintenance & lubrication instructions.
  2. Summary list of mechanical equipment requiring lubrication

showing name of equipment, location and type, and frequency of lubrication.

3. List of mechanical equipment used indicating name, model, serial number, and name plate data of each item together with number and name associated with each system item.
4. List spare parts and quantities to be maintained in ready inventory at project site.

### 1.13 WARRANTIES AND GUARANTIES

- A. Guarantee all material and workmanship under this Division for a period of one year, (compressors five (5) years) from the date of final acceptance by the Owner.
- B. During guarantee period, all defects developing through materials and/or workmanship shall be replaced immediately without expense to the owner. Make such repairs or replacements to the satisfaction of the Owner.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. As specified on drawings.

### 2.2 MATERIALS

- A. As specified on drawings.

### 2.3 EQUIPMENT DEVIATIONS

- A. Where the Contractor proposed to use an item of equipment other than that specified or detailed on the drawings which requires the redesign of the structure, partitions, foundations, piping, wiring or any other part of the mechanical, electrical or architectural layout, all such redesign, and all new drawings and detailing required therefore, shall be prepared at the Contractor's expense and are subject to the review and approval of the Owner or his authorized representative. Owner reserves the right to have the Architect or Engineer of his choice prepare any redesign work.
- B. Where such accepted deviation requires a different quantity and arrangement of ductwork, piping, wiring, conduit, and equipment from that specified or indicated on the drawings, the Contractor will provide ductwork, piping, structural supports, insulation, controllers, motors,

starters, electrical wiring and conduit, or other additional equipment required at no additional cost to the Owner.

- C. When equipment or methods deviate from original plans or specifications, the Contractor must submit a written request to deviate to the Engineer. At a minimum the request will address the following:

- equipment which is different than specified
- name and data related to the proposed deviation
- reason for deviation
- advantageous or disadvantageous to the Owner
- credit or increase in cost to the Owner
- guarantees or warranties offered (if any)
- acceptance of liability for equivalent performance.

## 2.4 MANUFACTURER'S IDENTIFICATION

- A. Attach manufacturer's nameplate, name, trademark and address permanently to equipment and material furnished under this Division. Nameplate of a Contractor or Distributor is not acceptable.

## 2.5 ELECTRICAL REQUIREMENTS

- A. Motors:

1. Electric motors furnished as a component part of equipment furnished under this Division shall conform to the requirements of IEEE, NEMA, UL, ANSI C50, and ANSI C1. Motors to be suitable for required load, duty voltage, phase, frequency, service and location.
2. Motors to be suitable for continuous duty at rated horsepower with temperature rise not to exceed 40°C for drip-proof motors, 50°C for splash-proof motors, and 55°C for totally enclosed motors. Motors to be capable of withstanding momentary overloads of 25 percent without injurious overheating.
3. Motors to have nameplates giving Manufacturer's name, serial number, horsepower, speed and current characteristics.
4. Motors smaller than 1 HP to be capacitor start or split-phase type designed for 120 volts, single phase, 60 cycles alternating current. Motors 1 HP and larger to be squirrel-cage induction or wound rotor, induction type, 3 phase, 60 cycles, alternating current.
5. Motor leads shall be permanently identified and supplied with

connectors.

6. Each motor to be selected for quiet operation in accordance with NEMA standards.

B. Motor Starters:

1. Electric motor starters shall conform to requirements of IEEE, NEMA, UL, ANSI, CI and shall be suitable for the required load, duty, voltage, phase, frequency, service, and location.
2. When interlocking or automatic control of single-phase motors is required, motors to be furnished with full voltage, across-the-line starters.

C. Connections:

1. Power wiring to be furnished and installed complete from power source to motor or equipment junction box, including power wiring through the starters. Starters not factory mounted on equipment shall be furnished and installed under Division 16.

## 2.6 MECHANICAL REQUIREMENTS

A. Bases & Supports:

1. Provide necessary foundations, supports, pads, bases and piers required for equipment, piping, motors, and other equipment furnished under this Division. Submit drawings to Owner for review before purchase, fabrication, or construction.
2. Construction of foundations, supports, pads, bases, and piers where mounted on the floor to be of the same materials and same quality of finish as the adjacent surrounding flooring material.
3. Securely attach equipment to building structure. Attachments that are, in the opinion of the Owner or his authorized representative deficient, will be replaced as directed.

B. Vibration Isolation:

1. Provide vibration isolation features and related installation in accordance with manufacturer requirements and engineer's recommendations.

C. Lubrication:

1. Lubricate all equipment having moving parts and requiring lubrication according to manufacturer's recommendations prior to testing and operation. Equipment discovered to have been operated before lubrication is subject to rejection and replacement at no cost to the Owner.

D. Accessibility:

1. Be responsible for the sufficiency of the size of shafts and chases, adequate clearance in double partitions and hung ceilings for proper installation of work. Cooperate with the Contractor and other contractors whose work is in the same space. Advise the Contractor of requirements. Such spaces and clearances shall be kept to the minimum size required.
2. Locate all equipment which requires servicing in fully accessible positions. Equipment shall include but not be limited to, valves, traps, clean-outs, motors, controllers, and drain points. If required for better accessibility furnish access doors for the purpose. Minor deviations from the drawings may be made to allow for better accessibility. Any change shall be submitted to the Owner or his authorized representative for review.

E. Connection to Existing Structures:

1. Before cutting, drilling, attaching, or any work involving building elements, coordinate work with others and Owner to avoid damage to building elements.

F. Quiet Operation:

1. Objectionable noise or vibration transmitted to occupied portions of the building by apparatus, piping, ducts, or other parts of the work to be remedied.

## 2.7 FIRESTOPPING

- A. Fire-stopping material shall be UL listed and tested silicone elastomer specifically formulated for use in horizontal and vertical applications shall possess intumescent characteristics; upon exposure to heat above 250 degrees F. shall expand to not less than five times its original volume to form a fireproof envelope UL rated for 2 and 3 hour protection, when applied in accordance with the manufacturer's recommendation.

### PART 3 - EXECUTION

#### 3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

#### 3.2 MECHANICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
  - 1. Coordinate mechanical systems, equipment, and materials installation with other building components.
  - 2. Verify all dimensions by field measurements.
  - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
  - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  - 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work.
  - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
  - 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
  - 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. 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 Engineer.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. 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. Extend grease fittings to an accessible location.
11. Install access panel or doors where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

### 3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with, the following requirements:
  1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
  1. Uncover Work to provide for installation of ill-timed Work.
  2. Remove and replace defective Work.
  3. Remove and replace Work not conforming to requirements of the Contract Documents.
  4. Remove samples of installed Work as specified for testing.
  5. Install equipment and materials in existing structures.
  6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
- C. 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.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
  - 1. 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.
  - 2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

### 3.4 FIRE STOPPING

- A. Firestopping: Unused slots, sleeves and other penetrations in floor, walls or other general construction shall be closed and sealed with an approved firestopping material.
  - 1. Floor slots and openings shall be closed with 16 gage galvanized steel sheet supported on 1-inch by 1-inch by 1/8 inch structural angle drilled or supported with powder driven studs into the building structure. Firestop with a layer of silicone elastomer not less than 1-inch thick which completely fills the opening. The top surface of the silicone elastomer shall be approximately 1-inch below the finished floor slab.
  - 2. Openings in walls shall be closed with 16 gage galvanized steel sheet securely attached at the midpoint of the wall thickness and firestopped on both sides of steel sheet with not less than 1/8-inch thick layer of non-sagging silicone elastomer to fully cover the opening.
  - 3. Single or multiple pipes passing through walls and floors shall have the annular space between pipes or between pipes and structure filled with silicone elastomer to provide a 3-hour rated firestop for floors and walls.
- B. Pipe and ducts: The annulus between exposed pipe and ductwork and walls or floors in finished spaces shall be filled, sealed, and painted to match adjacent surfaces.



### 3.5 FIELD QUALITY CONTROL

- A. Perform field tests as specified under other sections.
- B. Arrange for local inspection authorities to inspect work performed prior to burial, closing-in behind wall and above ceiling or encase in concrete. Also arrange for final inspection of work and obtain Final Inspection Certificate before final inspection by Owner or his representative.

### 3.6 PAINTING

- A. See Division 9 for painting in finished areas.
- B. Materials shipped to the job site under this Division to have prime coat and standard manufacturer's finish.

### 3.7 EQUIPMENT IDENTIFICATION

- A. Equipment Identification:
  - 1. Identify air handling units, heaters, and condensing units with the following data engraved in white on black laminated plastic (2" x 3") and fastened to equipment with screws.
    - a. Equipment mark noted on Drawings (i.e., EF-1).
    - b. Area served.

### 3.8 CLEANING

- A. Thoroughly clean ducts and equipment of foreign substances before making operational.
- B. Any part of a system stopped by foreign matter after being placed in operation, to be disconnected, cleaned, and reconnected to locate and remove obstructions. Work damaged in the course of removing obstructions will be repaired or replaced at no additional cost to the Owner.
- C. Cap all ducts and pipes to protect against entrance of foreign matter.
- D. Remove rubbish, debris, and excess materials. Remove oil and grease stains on floor areas.

END OF SECTION 15010

SECTION 15050  
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions apply to this Section.

1.2 SUMMARY

- A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Concrete equipment base construction requirements.
  - 3. Equipment nameplate data requirements.
  - 4. Nonshrink grout for equipment installations.
  - 5. Field-fabricated metal and wood equipment supports.
  - 6. Installation requirements common to equipment specification sections.
  - 7. Cutting and patching.
  - 8. Touch-up painting and finishing.
- B. Pipe and pipe fitting materials are specified in piping system Sections.

1.3 DEFINITIONS

- A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.
- B. 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.
- C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

- E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data for following piping specialties:
  - 1. Mechanical sleeve seals.
  - 2. Identification materials and devices.
- C. Samples of color, lettering style, and other graphic representation required for each identification material and device.
- D. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.
- E. Coordination drawings for access panel and door locations.
- F. Prepare coordination drawings to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:
  - 1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
    - a. Planned piping layout, including valve and specialty locations and valve stem movement.
    - b. Planned duct systems layout, including elbows radii and duct accessories.
    - c. Clearances for installing and maintaining insulation.
    - d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    - e. Equipment service connections and support details.
    - f. Exterior wall and foundation penetrations.
    - g. Fire-rated wall and floor penetrations.

- h. Sizes and location of required concrete pads and bases.
  - 2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
  - 3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
  - 4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.
- G. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article of this Section.

#### 1.5. QUALITY ASSURANCE

- A. Qualify welding processes and operators for structural steel according to AWS D1.1 "Structural Welding Code - Steel."
- B. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.
- C. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
- D. 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.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. 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.
- B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.

- C. Protect flanges, fittings, and piping specialties from moisture and dirt.
- D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 SEQUENCING AND SCHEDULING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
- C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
- D. 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.
- E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- F. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.
- G. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 PIPE AND PIPE FITTINGS

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

### 2.2 JOINING MATERIALS

- A. Refer to individual piping system specification Sections in Division 15 for special joining materials not listed below.
- B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
  - 2. ASME B16.20 for grooved, ring-joint, steel flanges.
  - 3. AWWA C110, rubber, flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.
- D. Plastic Pipe Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated.
- E. Solder Filler Metal: ASTM B 32.
  - 1. Alloy Sn95 or Alloy Sn94: Tin (approximately 95 percent) and silver (approximately 5 percent), having 0.10-percent lead content.
  - 2. Alloy Sn50: Tin (50 percent) and lead (50 percent).
  - 3. Alloy E: Tin (approximately 95 percent) and copper (approximately 5 percent), having 0.10-percent maximum lead content.
  - 4. Alloy HA: Tin-antimony-silver-copper-zinc, having 0.10-percent maximum lead content.
  - 5. Alloy HB: Tin-antimony-silver-copper-nickel, having 0.10-percent maximum lead content.
  - 6. Alloy Sb5: Tin (95 percent) and antimony (5 percent), having 0.20-percent maximum lead content.
- F. Brazing Filler Metals: AWS A5.8.
  - 1. BCuP Series: Copper-phosphorus alloys.
  - 2. BAg1: Silver alloy.

- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements: Manufacturer's standard solvents complying with the following:
  - 1. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235.
  - 2. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM F 493.
  - 3. Poly(Vinyl Chloride) (PVC): ASTM D 2564.
  - 4. PVC to ABS Transition: Made to requirements of ASTM D 3138, color other than orange.
- I. Plastic Pipe Seals: ASTM F 477, elastomeric gasket.
- J. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.
- K. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.
  - 1. Sleeve: ASTM A 126, Class B, gray iron.
  - 2. Followers: ASTM A 47, Grade 32510 or ASTM A 536 ductile iron.
  - 3. Gaskets: Rubber.
  - 4. Bolts and Nuts: AWWA C111.
  - 5. Finish: Enamel paint.

### 2.3 PIPING SPECIALTIES

- A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.
  - 1. Inside Diameter: Closely fit around pipe, tube, and insulation of insulated piping.
  - 2. Outside Diameter: Completely cover opening.
  - 3. Cast Brass: One-piece, with set-screw.
    - a. Finish: Rough brass.
    - b. Finish: Polished chrome plate.
  - 4. Cast Brass: Split casting, with concealed hinge and set-screw.
    - a. Finish: Rough brass.
    - b. Finish: Polished chrome plate.
  - 5. Stamped Steel: One-piece, with set-screw and chrome plated finish.
  - 6. Stamped Steel: One-piece, with spring clips and chrome plated finish.

7. Stamped Steel: Split plate, with concealed hinge, set-screw, and chrome plated finish.
  8. Stamped Steel: Split plate, with concealed hinge, spring clips, and chrome plated finish.
  9. Stamped Steel: Split plate, with exposed-rivet hinge, set-screw, and chrome plated finish.
  10. Stamped Steel: Split plate, with exposed-rivet hinge, spring clips, and chrome plated finish.
  11. Cast-Iron Floor Plate: One-piece casting.
- B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
  2. Insulating Material: Suitable for system fluid, pressure, and temperature.
  3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg F temperature.
  4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
  5. 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.
    - a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
  6. Dielectric Couplings: Galvanized-steel coupling, having inert and non-corrosive, thermoplastic lining, with threaded ends and 300 psig minimum working pressure at 225 deg F temperature.
  7. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive, thermoplastic lining, with combination of plain, threaded, or grooved end types and 300 psig working pressure at 225 deg F temperature.
- C. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.
- D. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:
1. Steel Sheet-Metal: 24 gage or heavier, galvanized sheet metal, round tube closed with welded longitudinal joint.



2. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
  - a. Penetrating Pipe Deflection: 5 percent without leakage.
  - b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
  - c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
  - d. Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.
5. Cast-Iron Sleeve Fittings: Commercially-made, sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
  - a. Underdeck Clamp: Clamping ring with set-screws.
6. PVC Plastic: Manufactured, permanent, with nailing flange for attaching to wooden forms.
7. PE Plastic: Manufactured, reusable, tapered, cup-shaped, smooth outer surface, with nailing flange for attaching to wooden forms.

#### 2.4 IDENTIFYING DEVICES AND LABELS

- A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. Where more than single type is specified for listed application, selection is Installer's option, but provide single selection for each product category.
- B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
  1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
  2. Location: An accessible and visible location.
- C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar

applications, but not less than 1-1/4-inches-high letters for ductwork and not less than 3/4-inch-high letters for access door signs and similar operational instructions.

1. Material: Fiberboard.
  2. Material: Brass.
  3. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
  4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.
- D. Snap-On Plastic Pipe Markers: Manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, conforming to ASME A13.1.
- E. Pressure-Sensitive Pipe Markers: Manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, conforming to ASME A13.1.
- F. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white (letter color) melamine subcore, except when other colors are indicated.
1. Fabricate in sizes required for message.
  2. Engraved with engraver's standard letter style, of sizes and with wording to match equipment identification.
  3. Punch for mechanical fastening.
  4. Thickness: 1/16 inch, except as otherwise indicated.
  5. Thickness: 1/8 inch, except as otherwise indicated.
  6. Thickness: 1/16 inch, for units up to 20 square inches or 8-inches long; 1/8 inch for larger units.
  7. Fasteners: Self-tapping stainless-steel screws or contact-type permanent adhesive.
- G. Plastic Equipment Markers: Laminated-plastic, color-coded equipment markers. Conform to following color code:
1. Yellow: Heating equipment and components.
  2. Brown: Energy reclamation equipment and components.
  3. Blue: Equipment and components that do not meet any of above criteria.
  4. For hazardous equipment, use colors and designs recommended by ASME A13.1.

5. Nomenclature: Include following, matching terminology on schedules as closely as possible:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.
  6. Size: Approximate 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.
- H. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.
1. Multiple Systems: Where multiple systems of same generic name are indicated, provide identification that indicates individual system number as well as service such as "Boiler No. 3," "Air Supply No. 1H," or "Standpipe F12."

## 2.5 GROUT

- A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  2. Design Mix: 5000 psi, 28-day compressive strength.
  3. Packaging: Premixed and factory-packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. 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.
- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

- C. Install piping at indicated slope.
- D. Install components having pressure rating equal to or greater than system operating pressure.
- E. Install piping free of sags and bends.
- F. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.
- G. 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.
- H. Install piping to allow application of insulation plus 1-inch clearance around insulation.
- I. Locate groups of pipes parallel to each other, spaced to permit valve servicing.
- J. Install fittings for changes in direction and branch connections.
- K. Install couplings according to manufacturer's printed instructions.
- L. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:
  - 1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw, and polished chrome-plated finish. Use split-casting escutcheons where required, for existing piping.
  - 2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.
  - 3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.
  - 4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.
  - 5. Piping in Utility Areas: Cast-brass or stamped-steel, with set-screw or spring clips.
- M. Sleeves are not required for core drilled holes.
- N. Permanent sleeves are not required for holes formed by PE plastic (removable) sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

- P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.
1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.
  2. Build sleeves into new walls and slabs as work progresses.
  3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. PVC Pipe Sleeves: For pipes smaller than 6 inches.
    - b. Steel Pipe Sleeves: For pipes smaller than 6 inches.
    - c. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger, penetrating gypsum-board partitions.
    - d. 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 above finished floor level. Flashing is specified in Division 16 Section "Basic Electrical Materials and Methods."
    - e. Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.
  4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."
- Q. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
1. Install steel pipe for sleeves smaller than 6 inches.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger.
  3. Assemble and install mechanical seals according to manufacturer's printed instructions.
- R. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

- S. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.
- T. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material.
- U. Verify final equipment locations for roughing-in.
- V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification Sections.
  - 1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - 2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - 3. Soldered Joints: Construct joints according to AWS "Soldering Manual," Chapter 22 "The Soldering of Pipe and Tube."
  - 4. Brazed Joints: Construct joints according to AWS "Brazing Manual," Chapter 28 "Pipe and Tube."
  - 5. 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:
    - 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. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
    - c. Align threads at point of assembly.
    - d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
    - e. 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.
  - 6. Welded Joints: Construct joints according to AWS D10.12 "Recommended Practices and Procedures for Welding Low Carbon Steel Pipe" using qualified processes and welding operators according to "Quality Assurance" Article.

7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.
8. Plastic Pipe and Fitting Solvent-Cement Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join pipe and fittings according to the following standards:
  - a. Comply with ASTM F 402 for safe handling practice of solvent-cement and primers.
  - b. Acrylonitrile-Butadiene-Styrene (ABS): ASTM D 2235 and ASTM D 2661.
  - c. Chlorinated Poly(Vinyl Chloride) (CPVC): ASTM D 2846 and ASTM F 493.
  - d. Poly(Vinyl Chloride) (PVC) Pressure Application: ASTM D 2672.
  - e. Poly(Vinyl Chloride) (PVC) Non-Pressure Application: ASTM D 2855.
  - f. PVC to ABS (Non-Pressure) Transition: Procedure and solvent cement described in ASTM D 3138.
9. Plastic Pipe and Fitting Heat-Fusion Joints: Prepare pipe and fittings and join with heat-fusion equipment, according to manufacturer's printed instructions.
  - a. Plain-End Pipe and Fittings: Butt joining.
  - b. Plain-End Pipe and Socket-Type Fittings: Socket-joining.
- X. Piping Connections: Except as otherwise indicated make piping connections as specified below.
  1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.
  2. Install flanges, in piping 2-1/2-inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
  3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  4. Wet Piping Systems (Water and Steam): Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide the maximum possible headroom, where mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Engineer.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.
- D. 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.
- E. Install equipment giving right-of-way to piping systems installed at a required slope.

### 3.3 LABELING AND IDENTIFYING

- A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.
  - 1. Stenciled Markers: Complying with ASME A13.1.
  - 2. Plastic markers, with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.
  - 3. Locate pipe markers as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
    - a. Near each valve and control device.
    - b. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
    - c. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
    - d. At access doors, manholes, and similar access points that permit view of concealed piping.
    - e. Near major equipment items and other points of origination and termination.
    - f. Spaced at a maximum of 50 feet intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.



- g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
  - 1. Lettering Size: Minimum 1/4-inch-high lettering for name of unit where viewing distance is less than 2 feet, 1/2-inch-high for distances up to 6 feet, and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
  - 2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.
- C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.
  - 1. Location: In each space where ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet.
- D. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

### 3.4 PAINTING AND FINISHING

- A. Damage and Touch-Up: Repair marred and damaged factory painted finishes with materials and procedures to match original factory finish.

### 3.5 CONCRETE BASES

- A. Construct concrete equipment bases of dimensions indicated, but not less than 6 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3500 psi, 28-day compressive strength concrete and reinforcement.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

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

### 3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
- B. 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.
- C. Attach to substrates as required to support applied loads.

### 3.8 CUTTING AND PATCHING

- A. 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.
- B. Repair cut surfaces to match adjacent surfaces.

END OF SECTION 15050

SECTION 15100  
VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes general duty valves common to most mechanical piping systems.
  - 1. Special purpose valves are specified in individual piping system specifications.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. 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.

1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: Comply with the requirements specified in Division 1 Section "MATERIALS AND EQUIPMENT."
- B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

- C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Preparation For Transport: Prepare valves for shipping as follows:
  1. Ensure valves are dry and internally protected against rust and corrosion.
  2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
  3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.
- B. Storage: Use the following precautions during storage:
  1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
  2. 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 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers:
  1. Engineer approved equal

### 2.2 VALVE FEATURES, GENERAL

- A. Valve Design: Rising stem or rising outside screw and yoke stems as indicated.
  1. Nonrising stem valves may be used where indicated.
- B. Pressure and Temperature Ratings: As required to suit system pressures and temperatures.
- C. Sizes: Same size as upstream pipe, unless otherwise indicated.

- D. Operators: Provide the following special operator features:
1. Handwheels, fastened to valve stem, for valves other than quarter turn.
  2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves.
- E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.
- G. End Connections: As indicated in the valve specifications.
1. Threads: Comply with ANSI B1.20.1.
  2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
  3. Solder-Joint: Comply with ANSI B16.18.
    - a. 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.

## 2.3 GATE VALVES

- A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 125, body and 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. Provide Class 150 valves meeting the above where system pressure requires.
- B. Gate Valves, 2-1/2-Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

## 2.4 BALL VALVES

- A. Ball Valves, 1 Inch and Smaller: Rated for 150 psi saturated steam pressure, 400 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.

- B. Ball Valves, 1-1/4-Inch to 2-Inch: Rated for 150 psi saturated steam pressure, 400 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 solder ends for domestic hot and cold water service; threaded ends for heating hot water.

## 2.5 PLUG VALVES

- A. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG; bronze body, with straightaway pattern, square head, and threaded ends.
- B. Plug Valves, 2-1/2-Inch and Larger: MSS SP-78; rated at 175 psi WOG; lubricated plug type, with semisteel body, single gland, wrench operated, and flanged ends.

## 2.6 GLOBE VALVES

- A. Globe Valves, 2-Inch and Smaller: MSS SP-80; Class 125; body and screwed bonnet of ASTM B 62 cast bronze; with threaded or solder ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 150 valves meeting the above where system pressure requires.
- B. Globe Valves, 2-1/2-Inch and Larger: MSS SP-85; Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; with outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing, and two-piece backing gland assembly.

## 2.7 BUTTERFLY VALVES

- A. Butterfly Valves, 2-1/2-Inch and Larger: MSS SP-67; rated at 200 psi; cast-iron body conforming to ASTM A 126, Class B. Provide valves with field replaceable EPDM sleeve, nickel-plated ductile iron disc (except aluminum bronze disc for valves installed in condenser water piping), stainless steel stem, and EPDM O-ring stem seals. Provide lever operators with locks.

## 2.8 CHECK VALVES

- A. 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.

- B. Swing Check Valves, 2-1/2-Inch and Larger: MSS SP-71; Class 125 cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. 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.
- B. 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.
- C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Replace defective valves with new valves.

#### 3.2 VALVE ENDS SELECTION

- A. Select valves with the following ends or types of pipe/tube connections:
  - 1. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
  - 2. Steel Pipe Sizes, 2-Inch and Smaller: threaded ends.
  - 3. Steel Pipe Sizes 2-1/2 Inch and Larger: flanged ends.

#### 3.3 VALVE INSTALLATIONS

- A. General Application: Use gate, ball, and butterfly valves as indicated.
- B. Locate valves for easy access and provide separate support where necessary.
- C. 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.
- D. Install valves in horizontal piping with stem at the center of the pipe.
- E. Install valves in a position to allow full stem movement.
- F. Installation of Check Valves: Install for proper direction of flow as follows:
  - 1. Swing Check Valves: Horizontal position with hinge pin level.

### 3.4 SOLDER CONNECTIONS

- A. Cut tube square and to exact lengths.
- B. 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.
- C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.
- D. Open gate and globe valves to full open position.
- E. Remove the cap and disc holder of swing check valves having composition discs.
- F. 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.
- G. 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.

### 3.5 THREADED CONNECTIONS

- A. 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.



- 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.

### 3.6 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

### 3.7 FIELD QUALITY CONTROL

- A. 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.

### 3.8 ADJUSTING AND CLEANING

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

### 3.9 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

#### VALVES, 2-INCH AND SMALLER

SERVICE	GATE	GLOBE	BALL	CHECK
Domestic Hot and Cold Water	125	125	150	125
Heating Hot Water	150	150	150	150
Chilled Water	150	150	150	150

#### VALVES, 2-1/2-INCH AND LARGER

SERVICE	GATE	GLOBE	BUTTERFLY	CHECK
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Domestic Hot and Cold Water	125	125	200	125
Heating Hot Water	125	125	200	125
Chilled Water	125	125	200	125

END OF SECTION 15100

SECTION 15140  
SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes the following:
  - 1. Horizontal-piping hangers and supports.
  - 2. Vertical-piping clamps.
  - 3. Hanger-rod attachments.
  - 4. Building attachments.
  - 5. Saddles and shields.
  - 6. Spring hangers and supports.
  - 7. Miscellaneous materials.
  - 8. Equipment supports.
- B. Related sections: The following sections contain requirements that relate to this section:
  - 1. Division 15 Section "Mechanical Insulation" for pipe insulation.

1.3 DEFINITIONS

- A. Terminology used in this section is defined in MSS SP-90.

1.4 SUBMITTALS

- A. General: Submit the following in accordance with conditions of contract and Division 1 specification sections.
  - 1. Product data, including installation instructions for each type of support and anchor. Submit pipe hanger and support schedule showing

Manufacturer's figure number, size, location, and features for each required pipe hanger and support.

2. Product certificates signed by the manufacturer of hangers and supports certifying that their products meet the specified requirements.
3. Assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

### 1.5 QUALITY ASSURANCE

- A. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel."
  1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- B. Regulatory Requirements: Comply with applicable international plumbing code pertaining to product materials and installation of supports and anchors.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

- A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58 and MSS SP-69.
  1. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

### 2.2 MISCELLANEOUS MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installing until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69 and SP-89. Install supports with maximum spacings complying with current local and international Plumbing and Mechanical Codes. Where piping of various sizes is supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe as specified above for individual pipe hangers.
- B. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ASME B31.9 Building Services Piping Code is not exceeded.
- G. Insulated Piping: Comply with the following installation requirements.
  - 1. Shields: Install protective shields MSS Type 40 on cold water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

<u>NPS</u>	<u>LENGTH</u>	<u>THICKNESS</u>
1/4 THROUGH 3-1/2	12	0.048
4	12	0.060

- 2. Insert material shall be at least as long as the protective shield.

3. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

### 3.3 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe anchors and equipment supports. Install and align fabricated anchors in indicated locations.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours welded surfaces to match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

END OF SECTION - 15140

SECTION 15250  
MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated by requirements of this section.
- B. Types of mechanical insulation specified in this section include the following:
  - 1. Plumbing and Heating Piping Systems Insulation:
    - a. Fiberglass.
- C. Refer to Division-15 section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar services for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
- B. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
  - 1. Engineered approved equal.

### 2.2 PIPING INSULATION MATERIALS

- A. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated. K-factor maximum of 0.25 at 75 degrees F.
- B. Jackets for Piping Insulation: ASTM C 921, Type I (vapor barrier) for piping with temperatures below ambient, Type II for piping with temperatures above ambient.
  - 1. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- C. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.



- D. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

### 2.3 DUCTWORK INSULATION MATERIALS:

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1.
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, Class B-4.
- C. Jackets for Ductwork Insulation: ASTM C 921, Type I.
- D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

### 3.2 PLUMBING PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, drainage piping buried piping, fire protection piping, and pre-insulated equipment.
- B. Domestic Cold Piping:
  - 1. Application Requirements: Insulate the following cold plumbing piping systems:
    - a. Domestic cold water piping.
    - b. Plumbing vents within 6 lineal feet of roof outlet.
    - c. Waste Piping.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass: thickness per IECC with vapor barrier.
- C. Domestic Hot Supply and Return Piping:
  1. Application Requirements: Insulate the following hot plumbing piping systems:
    - a. Domestic hot water supply and return recirculating piping.
  2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 1" thick for pipe sizes up to 1-1/4" and 1-1/2" thick for pipe sizes 1 1/2" to 4". Note: Provide thickness as required per most current IECC standards.

### 3.3 HVAC PIPING SYSTEM INSULATION

- A. A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, and expansion joints.
- B. Cold Piping (40 degrees F (4.4 degrees C) to ambient):
  1. Application Requirements: Insulate the following cold HVAC piping systems:
    - a. HVAC chilled water supply and return piping.
    - b. HVAC make-up water piping.
    - c. Air conditioner condensate drain piping.
  2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
    - a. Fiberglass: 1" thick for pipe sizes up to and including 4", 1-1/2" thick for pipe sizes over 4".
- C. Hot Low Pressure Piping (to 250 degrees F (121 degrees C)):
  1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 15 psi, water piping up to 250 degrees F (121 degrees C)).

- a. HVAC hot water supply and return piping.
  - b. Low pressure steam and condensate piping
  - c. Condenser water supply and return piping.
  - d. Heated fuel piping.
  - e. Hot gas refrigerant piping.
2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
- a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/2" through 4", 2" thick for pipe over 5".

### 3.4 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose. All proposed piping shall be insulated.
- B. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- C. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- E. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- F. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- G. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

### 3.4 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 15250

SECTION 15411  
WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes domestic cold water and domestic hot water piping, fittings, and specialties within the building to a point 5 feet outside the building.

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.
  - 1. Product data for each pipe, piping specialty and valve specified.
  - 2. Test reports specified in Part 3 of this Section.
  - 3. Maintenance data for each piping specialty and valve specified for inclusion in Maintenance Manual.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store pipe in a manner to prevent sagging and bending.

1.4 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of pipe sleeves for foundation wall penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:
  - 1. Backflow Preventers:
    - a. Cla-Val Co.
    - b. Febco
    - c. Hersey Products, Inc.
    - d. Watts Regulator Co.
    - e. Zurn Industries Inc. Wilkins Regulator Div.

2.2 PIPE AND TUBE MATERIALS, GENERAL

- A. Copper Tube: ASTM B 88, Type L Water Tube, drawn temper.

- B. Copper Tube: ASTM B88, Type K, water tube drawn temper..

### 2.3 FITTINGS

- A. Wrought Copper Solder-Joint Fittings: ANSI B16.22, streamlined pattern.
- B. Wrought Copper and Bronze Grooved-End Fittings: ASTM B 75 Tube and ASTM B 584 Bronze Castings.
- C. Bronze Flanges: ANSI B16.24, Class 150, raised ground face, bolt holes spot faced.
- D. Unions: ASME 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 ASME B1.20.1.
- E. Dielectric Unions: Threaded, solder, or grooved-end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.

### 2.4 JOINING MATERIALS

- A. Solder Filler Metal: ASTM B 32, 95-5 Tin-Antimony.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.
- C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and design temperatures and pressures.

### 2.5 GENERAL-DUTY VALVES

- A. General-duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 15 Section "Valves." Special duty valves are specified below by their generic name; refer to Part 3 Article "Valve Application" for specific uses and applications for each valve specified.

### 2.6 PIPING SPECIALTIES

- A. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.
- B. Relief Valves: Sizes for relief valves shall be in accordance with ASME Boiler and Pressure Vessel Codes for indicated capacity of the appliance for which installed.

1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Temperature relief valves shall be factory set at 210 deg F, and pressure relief at 150 psi.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine rough-in requirements for plumbing fixtures and other equipment with water connections to verify actual locations of piping connections prior to installation.

#### 3.2 PIPE APPLICATIONS

- A. Install Type L, drawn copper tube with wrought copper fittings and solder joints for pipe sizes 3 inches and smaller, above ground, within building.
- B. Install copper type K for pipe 2" and smaller, below ground, inside and outside building.

#### 3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- B. Use fittings for all changes in direction and branch connections.
- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated.
- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, where feasible.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation.

- G. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.
- H. Install drains at low points in mains consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.
- I. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls with sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inches shall be galvanized steel pipe; pipe sleeves 6 inches and larger shall be galvanized steel sheet metal.
- J. Fire Barrier Penetrations: Where pipes pass through fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity.
- K. Install piping level with no pitch.

### 3.4 HANGERS AND SUPPORTS

- A. General: Hanger, support, and anchor devices conforming to MSS SP-69 are specified in Division 15 Section "Supports and Anchors." Conform to the table below for maximum spacing of supports:
- B. Pipe Attachments: Install the following:
  - 1. Adjustable steel clevis hangers, MSS Type 1, for individual horizontal runs less than 20 feet in length.
- C. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

<u>Nom. Pipe Size - In.</u>	<u>Copper Tube Max. Span - Ft.</u>	<u>Min. Rod Dia. - In.</u>
Up to 3/4	6	3/8
1	6	3/8
1-1/4	6	3/8
1-1/2	10	3/8
2	10	3/8
2-1/2	10	1/2
3	10	1/2

- D. Support vertical copper tube at each floor.

### 3.5 PIPE AND TUBE JOINT CONSTRUCTION



- A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."
- B. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
  - 1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering and brazing.
  - 2. Fill the tubing and fittings during soldering and brazing with an inert gas (nitrogen or carbon dioxide) to prevent formation of scale.
  - 3. Heat joints to proper and uniform temperature.
- C. Threaded Joints: Conform to ASME B1.20.1, tapered pipe threads for field-cut threads. 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. 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.
    - a. Damaged Threads: Do not use pipe with corroded or damaged threads. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- D. Flanged Joints: Align flange surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- E. Grooved-End Joints: Prepare pipe and tubing and install in accordance with manufacturer's installation instructions.
- F. Provide dielectric unions between pipes of dissimilar metals.

### 3.6 VALVE APPLICATIONS

- A. General-Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shut-off duty: Use gate or ball valves.
  - 2. Throttling duty: Use globe or ball valves.

### 3.7 INSTALLATION OF VALVES

- A. Sectional Valves: Install sectional valves as indicated. For sectional valves 2 inches and smaller, use gate or ball valves; for sectional valves 2-1/2 inches and larger, use gate valves.
- B. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, on each supply to each plumbing fixture, and elsewhere as indicated. For shutoff valves 2 inches and smaller, use gate or ball valves; for shutoff valves 2-1/2 inches and larger, use gate valves.
- C. Drain Valves: Install drain valves on each plumbing equipment item, located to drain equipment completely for service or repair. Install at low points of horizontal runs, and elsewhere as required to drain distribution piping system completely. For drain valves 2 inches and smaller, use gate or ball valves; for drain valves 2-1/2 inches and larger, use gate valves.
- D. Check Valves: Install swing check valves on discharge side of each pump and elsewhere as indicated.
- E. Balance Cocks: Install in each hot water recirculating loop, discharge side of each pump, and elsewhere as indicated.

### 3.8 INSTALLATION OF PIPING SPECIALTIES

- A. Provide backflow preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected.

### 3.9 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by plumbing code.
- B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide shutoff valve and

union for each connection; provide drain valve on drain connection. For connections 2-1/2 inches and larger, use flanges instead of unions.

### 3.10 FIELD QUALITY CONTROL

#### A. Inspections: Inspect water distribution piping as follows:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
2. During the progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
  - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed in after system is roughed in and prior to setting fixtures.
  - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
3. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
4. Reports: Prepare inspection reports signed by the plumbing official.

#### B. Test water distribution piping as follows:

1. Test for leaks and defects all new water distribution piping systems and parts of existing systems that have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
3. Cap and subject the piping system to a static water pressure of 110 psig without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.

4. Repair all leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
5. Prepare reports for all tests and required corrective action.

### 3.11 ADJUSTING AND CLEANING

- A. Balance recirculating hot water systems so that hot water is recirculated in all areas of the loop.
- B. Clean and disinfect water distribution piping as follows:
  1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
  2. Use the purging and disinfecting procedure proscribed by the authority having jurisdiction or, in case a method is not proscribed by that authority, the procedure described in International Plumbing Code or as described below:
    - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
    - b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.
    - c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
    - d. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.
    - e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.
- C. Prepare reports for all purging and disinfecting activities.

### 3.12 COMMISSIONING

- A. Fill the system. Check compression tanks to determine that they are not air bound and that the system is completely full of water.
  
- B. Before operating the system, perform these steps:
  - 1. Close drain valve, hydrants, and hose bibs.
  - 2. Open valves to full open position.
  - 3. Remove and clean strainers.
  - 4. Check pumps for proper direction of rotation. Correct improper wiring.
  - 5. Lubricate pump motors and bearings.

END OF SECTION - 15411

SECTION 15420  
DRAINAGE AND VENT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.2 DEFINITIONS

- A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.
- B. Building Sewer: That part of the drainage system which extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.
- C. Drainage System: Includes all the piping within a public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.
- D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

1.3 SUBMITTALS

- A. Product data for the following products:
  - 1. Drainage piping specialties

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: comply with the provisions of the following:
  - 1. International Plumbing Code.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

- B. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

## PART 2 - PRODUCTS

### 2.1 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

- A. Copper Tube: ASTM B306, Type DWV for pipe, and cast-bronze, drainage pattern fittings, with soldered joints.
  - 1. Solder Filler Materials: ASTM B32, 50-50 tin-lead solder.
- B. Cast-Iron Soil Pipe: ASTM A74, Service weight, hub-and-spigot soil pipe and fittings.
  - 1. Clamps and compression gaskets: ASTM C564.
- C. Hubless Cast-Iron Soil Pipe: CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.

### 2.2 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

- A. Cast-Iron Soil Pipe: ASTM A74, Extra-Heavy weight, hub-and-spigot soil pipe and fittings. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.
  - 1. Neoprene Compression Gaskets: ASTM C564.

### 2.3 DRAINAGE PIPING SPECIALTIES

- A. Backwater Valves: Valve assembly shall be bronze fitted cast-iron, with bolted cover. Flapper shall provide a maximum 1/4 inch clearance between flapper and seat for air circulation. Valve ends shall suit piping material.
- B. Trap Primers: Bronze body valve with automatic vacuum breaker, with 1/2 inch connections matching piping system. Complying with ASSE 1018.

- C. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.
- D. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.
- E. Floor Cleanouts: Cast-iron body and frame, with cleanout plug and adjustable round top as follows:
  - 1. Nickel-Bronze Top: Manufacturer's standard cast unit with the following patterns:
    - a. Exposed rim type, with recess to receive 1/8 inch thick resilient floor finish.
    - b. Exposed rim type, with recess to receive 1 inch thick terrazzo floor finish.
    - c. Exposed finish type, standard mill finish.
    - d. Exposed flush type, standard non-slip scored or abrasive finish.
  - 2. Cast-iron Top: Manufacturer's standard cast unit with the following patterns:
    - a. Exposed flush type, standard mill finish.
    - b. Exposed flush type, standard non-slip scored or abrasive finish.
- F. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.
- G. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide underdeck clamp and sleeve length as required.
- H. Vent Flashing Sleeves: Cast-iron calking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- I. Frost-Proof Vent Caps: Construct of galvanized iron, sized to provide 1 inch air space between outside of vent pipe and inside of flashing collar extension.
- J. Vandal-Proof Vent Caps: Cast-iron body full size of vent pipe, with calked base connection for cast-iron pipes, threaded base for steel pipes.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION



- A. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- C. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 PIPE APPLICATIONS - ABOVE GROUND, WITHIN BUILDING

- A. Install copper tube with cast bronze fittings for 3 inch and smaller, drainage and vent pipe.
- B. Install hub-and-spigot, service weight, cast-iron soil pipe with lead and oakum calked joints for larger than 3 inch drainage and vent pipe.
- C. Install hub-and-spigot, service weight, cast-iron soil pipe with compression gasket joints for larger than 3 inch drainage and vent pipe.
- D. Install hubless, service weight, cast-iron soil pipe and fittings for larger than 3 inch drainage and vent pipe.

### 3.3 PIPE AND TUBE JOINT CONSTRUCTION

- A. Copper Tubing: Solder joints in accordance with the procedures specified in AWS "Soldering Manual."
- B. Cast-Iron Soil Pipe: Make lead and oakum calked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

### 3.4 INSTALLATION

- A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as required.
- B. Use fittings for all changes in direction and all branch connections.

- C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted.
- D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors.
- F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.
- G. 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.
- H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.
- I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment required with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inch and smaller, and 1/8 inch per foot (1 percent) for piping 4 inch and larger.

- L. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.
- M. Install 1 inch thick extruded polystyrene over underground building drain piping not under building. Width of insulation shall extend minimum of 12" beyond each side of pipe. Install directly over, and center on pipe center line.
- N. Insulate all waste stacks for their entire length, and continue over fittings etc.

### 3.5 HANGERS AND SUPPORTS

- A. General: Hanger, supports, and anchors devices are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes as required by current International Plumbing Codes and requirements of Governing Authorities:

### 3.6 INSTALLATION OF PIPING SPECIALTIES

- A. Install backwater valves in sanitary building drain piping as required, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.
- B. Install expansion joints on vertical risers as required, and as required by the plumbing code.
- C. Above Ground Cleanouts: Install in above ground piping and building drain piping as required, and:
  - 1. as required by plumbing code;
  - 2. at each change in direction of piping greater than 45 degrees;
  - 3. at minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
  - 4. at base of each vertical soil or waste stack.
- D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as required.
- E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

- F. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.
- G. Frost-Proof Vent Caps: Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1 inch clearance between vent pipe and roof substrate.

### 3.7 CONNECTIONS

- A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

### 3.8 FIELD QUALITY CONTROL

- A. Inspections
  - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
  - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
    - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
  - 3. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspected by the plumbing official.
  - 4. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Piping System Test: Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:

1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

### 3.9 ADJUSTING AND CLEANING

- A. Clean interior of piping system. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

### 3.10 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops

END OF SECTION 15420

SECTION 15440  
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes plumbing fixtures and trim, fittings, and accessories, appurtenances, and supports associated with plumbing fixtures.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 15 Section "Drainage and Vent Systems".
  - 2. Division 15 Section "Valves" for valves used as supply stops.
  - 3. Division 15 Section "Water Distribution Piping".

1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of plumbing fixture as scheduled on drawings, including fixture and trim, fittings, faucets, accessories, supports, construction details, dimensions of components, flow rates of fixtures, and finishes.

1.3 QUALITY ASSURANCE

- A. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Engineer. Burden of proof for equality of plumbing fixtures is on the proposer.
- B. Codes and Standards: As specified in Section 15010.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.
- B. Store plumbing fixtures on elevated platforms in a dry location.

## 1.5 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below matching products installed, packaged with protective covering for storage, and identified with labels clearly describing contents.
  - 1. Faucet Washers and O-rings: Furnish quantity of identical units not less than 10 percent of amount of each installed.
  - 2. Faucet Cartridges and O-rings: Furnish quantity of identical units not less than 5 percent of amount of each installed.
  - 3. Water Closet Tank Repair Kits: Furnish quantity of identical flush valve units not less than 5 percent of amount of each type installed.
  - 4. Toilet Seats: Furnish quantity of identical units not less than 5 percent of amount of each type toilet seat installed.

## PART 2 - PRODUCTS

### 2.1 PLUMBING FIXTURES, GENERAL

- A. Fixtures shall be in accordance with specifications and scheduled on the drawings.
- B. Flow rates shall comply with EPA WaterSense where applicable.
- C. Provide air chambers at all fixtures.

### 2.2 FAUCETS

- A. Faucets General: Unless otherwise specified, provide faucets that are cast brass with polished chrome-plated finish.

### 2.3 FITTINGS, EXCEPT FAUCETS

- A. Fittings General: Unless otherwise specified, provide fittings fabricated of brass, with a polished chrome plated finish.
- B. Sink Supplies and Stops: Handle angle stop, having 1/2-inch NPS inlet with wall flange and 1/2-inch by 12-inch flexible tubing riser outlet.
- C. Sink Traps: Cast brass, 1-1/2 inch NPS adjustable P-trap with cleanout, 17 gage tubular waste to wall, and wall flange.
- D. Sink Continuous Wastes: Polished chrome-plated, tubular brass, 1-1/2 inches, 17 gauge, with brass nuts on slip inlets, and of configurations indicated.

- G. Escutcheons: Polished chrome-plated, sheet steel wall flange with friction clips.
- H. Deep Pattern Escutcheons: Wall flange with set screw or sheet steel wall flange with friction clips, of depth adequate to conceal protruding roughing-in fittings.
- I. Provide fittings specified as part of a fixture description, in lieu of fitting requirements above.

#### 2.4 PLUMBING FIXTURE SUPPORTS

- A. Supports: ASME A112.6.1M, categories and types as required for wall-hanging fixtures specified, and wall reinforcement.
- B. Support categories are:
  - 1. Chair Carriers, Heavy Duty: Supports with rectangular steel uprights for wall-hanging fixtures.
  - 2. Reinforcement: 2-inch by 4-inch wood blocking between studs or 1/4-inch by 6-inch steel plates attached to studs, in wall construction, to secure floor-mounted and special fixtures to wall.
- C. Support Types: Provide support of category specified, of type having features required to match fixture.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in for potable cold water and hot water supplies and soil, waste, and vent piping systems to verify actual locations of piping connections prior to installing fixtures.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.2 APPLICATION

- A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings.



- B. Install supports for plumbing fixtures in accordance with categories indicated, and of type required:

### 3.3 INSTALLATION OF PLUMBING FIXTURES

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers' written installation instructions, roughing-in drawings, and referenced standards.
- B. Install water closets with closet flanges and gasket seals.
- C. Fasten wall hanging plumbing fixtures securely to supports attached to building substrate.
- D. Secure supplies behind wall or within wall pipe space, providing rigid installation.
- E. Install stop valve in an accessible location in each water supply to each fixture.
- F. Install trap on fixture outlet except for fixtures having integral trap.
- G. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.
- H. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant.

### 3.4 CONNECTIONS

- A. Piping installation requirements are specified in other sections of Division 15. The Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
  - 1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 15.

### 3.5 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

- B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

### 3.6 ADJUSTING AND CLEANING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at drinking fountains, electric water coolers, and faucets, and flushometers having controls, to provide proper flow and stream.
- C. Replace washers of leaking and dripping faucets and stops.
- D. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.
- E. Review the data in Operating and Maintenance Manuals.

### 3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities, except when approved in writing by the Owner.

### 3.8 FIXTURE SCHEDULE

- A. Provide plumbing fixtures as scheduled on the drawings.

END OF SECTION 15440

SECTION 15870  
POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of power ventilators:

1. Ceiling-mounted ventilators.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

1. Product data for selected models, including specialties, accessories, and the following:
  - a. Certified fan performance curves with system operating conditions indicated.
  - b. Certified fan sound power ratings.
  - c. Motor ratings and electrical characteristics plus motor and fan accessories.
  - d. Materials gages and finishes, including color charts.
  - e. Dampers, including housings, linkages, and operators.
2. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
3. Coordination drawings, in accordance with Division 15 Section "Basic Mechanical Requirements," for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:
  - a. Roof framing and support members relative to duct penetrations.
  - b. Ceiling suspension members.
  - c. Method of attaching hangers to building structure.
  - d. Size and location of initial access modules for acoustical tile.
  - e. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.
4. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field- installed wiring.

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

### 1.3 QUALITY ASSURANCE

- A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705 "Power Ventilators."
- B. UL Compliance: Fans and components shall be UL listed and labeled.
- C. 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.
- D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- E. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

### 1.4 DELIVERY, STORAGE, AND HANDLING

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

### 1.5 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of equipment supports, and roof penetrations specified in Division 7.
- B. Coordinate the size and location of structural steel support members.

### 1.6 EXTRA MATERIALS

- A. Furnish one additional complete set of belts for each belt-driven fan.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to, the following:
1. Centrifugal Roof Ventilators:
    - a. Carnes Company, Inc.
    - b. Cook (Loren) Co.
    - c. Greenheck Fan Corp.
  2. Ceiling-Mounted Ventilators:
    - a. Carnes Company, Inc.
    - b. Cook (Loren) Co.
    - c. Greenheck Fan Corp.

### 2.2 SOURCE QUALITY CONTROL

- A. Testing Requirements: The following factory tests are required:
- 1 Sound Power Level Ratings: Comply with AMCA Standard 301 "Method for Calculating Fan Sound Ratings From Laboratory Test Data." Test fans in accordance with AMCA Standard 300 "Test Code for Sound Rating." Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.
  - 2 Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA Standard 210/ASHRAE Standard 51 - Laboratory Methods of Testing Fans for Rating.

### 2.3 FANS, GENERAL

- A. General: Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.
- B. Fans and Shafts: Statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

1. Fan Shaft: Turned, ground, and polished steel designed to operate at no more than 70 percent of the first critical speed at the top of the speed range of the fan's class.
- C. Belt Drives: Factory mounted, with final alignment and belt adjustment made after installation.
1. Service Factor: 1.4.
- D. Belts: Oil-resistant, nonsparking, and nonstatic.
- E. Motors and Fan Wheel Pulleys: Adjustable pitch for use with motors through 15 HP; fixed pitch for use with motors larger than 15 HP. Select pulley so that pitch adjustment is at the middle of the adjustment range at fan design conditions.
1. Belt Guards: Provide steel belt guards for motors mounted on the outside of the fan cabinet.
- F. Shaft Bearings: Provide type indicated, having a median life "Rating Life" (AFBMA (L(50))) of 200,000, calculated in accordance with AFBMA Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.
- G. Factory Finish: The following finishes are required:
1. Sheet Metal Parts: Prime coating prior to final assembly.
  2. Exterior Surfaces: Baked-enamel finish coat after assembly.

## 2.4 CEILING-MOUNTED VENTILATORS

- A. General Description: Centrifugal fan designed for installation in ceiling, wall, or concealed inline applications.
- B. Housing: Galvanized steel lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Stainless steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

- F. Remote Fan Speed Control: Solid state, capable of controlling fan speed from full speed to approximately half speed.
- G. Accessories: Manufacturer's standard roof jack, wall cap, and transition fittings as required.

## 2.6 MOTORS

- A. Torque Characteristics: Sufficient to accelerate the driven loads satisfactorily.
- B. Motor Sizes: Minimum sizes and electrical characteristics as indicated. If not indicated, large enough so that the driven load will not require the motor to operate in the service factor range.
- C. Temperature Rating: 50 deg C maximum temperature rise at 40 deg C ambient for continuous duty at full load (Class A Insulation).
- D. Service Factor: 1.15 for polyphase motors and 1.35 for single-phase motors.
- E. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design B. Provide permanent-split capacitor classification motors for shaft-mounted fans and capacitor start classification for belted fans.
  - 1. Bases: Adjustable.
  - 2. Bearings: The following features are required:
    - a. Ball or roller bearings with inner and outer shaft seals.
    - b. Grease lubricated.
    - c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
  - 3. Enclosure Type: The following features are required:
    - a. Open drip-proof motors where satisfactorily housed or remotely located during operation.
    - b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
  - 4. Overload protection: Built-in, automatic reset, thermal overload protection.
  - 5. Noise rating: Quiet.
  - 6. Efficiency: Energy-efficient motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, Test Method B. If efficiency not specified, motors shall have a higher efficiency than

"average standard industry motors" in accordance with IEEE Standard 112, Test Method B.

7. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, and special features.
- F. Starters, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 16.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances, roof curbs, equipment supports, and other conditions affecting performance of fans.
- B. Do not proceed until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Install fans level and plumb, in accordance with manufacturer's written instructions. Support units as described below, using the vibration control devices indicated. Vibration control devices are specified in Division 15 Section "Vibration Controls."
  1. Suspended Units: Suspend units from structural steel support frame using threaded steel rods and vibration isolation springs.
- B. Arrange installation of units to provide access space around air- handling units for service and maintenance.

#### 3.3 CONNECTIONS

- A. Duct installations and connections are specified in other Division 15 sections. Make final duct connections with flexible connections.
- B. Electrical Connections: The following requirements apply:
  1. Electrical power wiring is specified in Division 16.
  2. Temperature control wiring and interlock wiring are specified in Division 15 Section "Electrical Control Systems."



3. Temperature control wiring and interlock wiring are specified in Division 15 Section "Pneumatic Control Systems."
4. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Inspection: Arrange and pay for a factory- authorized service representative to perform the following:
  1. Inspect the field assembly of components and installation of fans including ductwork and electrical connections.
  2. Prepare a written report on findings and recommended corrective actions.

### 3.5 ADJUSTING, CLEANING, AND PROTECTING

- A. Adjust damper linkages for proper damper operation.
- B. Clean unit cabinet interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

### 3.6 COMMISSIONING

- A. Final Checks Before Start-Up: Perform the following operations and checks before start-up:
  1. Remove shipping blocking and bracing.
  2. 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.
  3. Perform cleaning and adjusting specified in this Section.
  4. 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.
  5. Lubricate bearings, pulleys, belts, and other moving parts with factory-recommended lubricants.

6. Disable automatic temperature control operators.
- B. Starting procedures for fans:
    1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated RPM.
    2. Measure and record motor electrical values for voltage and amperage.
      - a. Replace fan and motor pulleys as required to achieve design conditions.
  - C. Shut unit down and reconnect automatic temperature control operators.

### 3.7 DEMONSTRATION

- A. Demonstration Services: Arrange and pay for a factory-authorized service representative to train Owner's maintenance personnel on the following:
  1. Procedures and schedules related to start-up and shutdown, troubleshooting, servicing, preventative maintenance, and how to obtain replacement parts.
  2. Familiarization with contents of Operating and Maintenance Manuals specified in Division 1 Section "Project Closeout" and Division 15 Section "Basic Mechanical Requirements."
- B. Schedule training with at least 7 days' advance notice.

END OF SECTION 15870

## SECTION 16010 – BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. 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 16.

#### 1.2 SUMMARY

- A. This Section includes general administrative, procedural, and other requirements for electrical installations. The following requirements are included in this Section to expand the requirements specified in Divisions 1 through 16:
  - 1. Submittals.
  - 2. Quality control.
  - 3. Definitions and abbreviations.
  - 4. Scheduling.
  - 5. Coordination drawings.
  - 6. Record documents.
  - 7. Maintenance manuals.
  - 8. Delivery, storage, and handling.
  - 9. Products.
  - 10. Rough-ins.
  - 11. Electrical installations.
  - 12. Permits and instructions.
  - 13. Field quality control.
  - 14. Protection.
  - 15. Additional work.
  - 16. Electrical schedules.
  - 17. Cutting and patching.

#### 1.3 SUBMITTALS

- A. General: Follow the procedures specified in Division 1.
- B. Increase, by the quantity listed below, the number of electrical related shop drawings, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Electrical Consulting Engineer.
  - 1. Shop Drawings - Initial Submittal: 1 additional blue- or black-line prints.
  - 2. Shop Drawings - Final Submittal: 1 additional blue- or black-line prints.
  - 3. Product Data: 1 additional copy of each item.
  - 4. Samples: 1 addition as set.
- C. Additional copies may be required by individual sections of these Specifications.

#### 1.4 QUALITY CONTROL

- A. Functional and Operational Test Procedure:

1. Test procedure to completely test all systems as to their functional and sequential operation.
  2. Submit two (2) draft copies for review before conducting test.
  3. Certify that the test procedure was used and testing completed, and that all systems are operational and functioning properly.
  4. Submit certified Test Procedure for review prior to the date of final inspection.
  5. Systems to be covered by test procedure:
    - a. Power Distribution
    - b. Lighting Systems
    - c. Emergency Lighting System
- B. Other Tests and Certifications for:
1. Grounding System: As specified under Section 16452.

#### 1.5 DEFINITIONS AND ABBREVIATIONS

- A. Electrical Definitions: As defined by NEC, Article 100.
- B. The term "indicated" shall mean "as shown on contract documents (specifications, drawings, and related attachments)".
- C. The term "provide" shall mean "to furnish, install and connect completely".
- D. The term "size" shall mean one or more of the following: "length, current and voltage rating, number of poles, NEMA size, and other similar electrical characteristics".
- E. The term "space" on panelboard and switchboard schedules shall mean "provide space to install the number of poles and size of the protective device indicated with all the necessary buss and fittings to install the device at some future date".

#### 1.6 SCHEDULING

- A. Coordinate electrical work with other divisions of this project.
- B. Coordinate electrical work with Owner.
- C. Written requests for approval for planned shutdowns or interruption of Owner's operation or equipment shall be made 72 hours prior to the start of the requested periods.
- D. Written notification for on site training of Owner's personnel shall be made 1 week prior to the start of the requested training period.

#### 1.7 COORDINATION DRAWINGS

- A. Prepare coordination drawings in accordance with Division 1 to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of electrical equipment and materials in relationship with other systems,

installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of major raceway systems, equipment, and materials. Include the following:
  - a. Clearances for servicing equipment, including space for equipment disassembly required for periodic maintenance.
  - b. Fire-rated wall and floor penetrations.
  - c. Equipment connections and support details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, raceway systems components, Exhaust/Kitchen hoods, and other ceiling-mounted devices.

#### 1.8 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:
  1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
  2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
  3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

#### 1.9 MAINTENANCE MANUALS

- A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment items:
  1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  2. 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.
  3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  4. Servicing instructions and lubrication charts and schedules.

1.10 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. As specified under other RELATED SECTIONS.

- B. As specified on Drawings.

2.2 MATERIAL

- A. General:

1. Unless otherwise indicated, all raceways for service, feeders, branch and control wiring are RSC or IMC. See Section 16110.
2. Unless otherwise indicated, wiring to equipment and motors shall be installed in liquid tight flexible conduit, or in interior dry locations in flexible metal conduit, with a maximum length of six (6) feet.
3. Unless otherwise indicated, all conductors to be copper THHN/THWN-2.
4. Unless otherwise indicated, all outlet and switch boxes to be cast iron with threaded hubs.
5. In interior protected locations, where recessed in ceiling and walls, outlet and switch boxes may be stamped steel.
6. Unless otherwise indicated, provide heavy duty grade, 20 ampere, receptacles and switches. Plates shall be 302 stainless steel, satin finish. Plates for surface mounted interior boxes may be stamped steel. Plates exposed to weather or water to be metal, weatherproof type. Receptacles, switches and associated cover plates color by Architect/Owner.

- B. As specified under RELATED SECTIONS.

- C. As specified on Drawings.

2.3 EQUIPMENT

- A. General:

1. Unless otherwise indicated, externally operated safety switches are unfused, solid neutral, heavy duty, and selected to meet the load requirements.

- B. As specified under RELATED SECTIONS.

- C. As specified on Drawings.

2.4 FABRICATION

- A. General:

1. Unless otherwise indicated, all enclosures are NEMA Type 1. NEMA Type 3R shall be used for wet/damp locations.
- B. As specified under RELATED SECTIONS.
- C. As specified on Drawings.

### PART 3 - EXECUTION

#### 3.1 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.
- C. Contractor is to provide connections, both power and control as noted, for Mechanical equipment. Division 16 shall coordinate the respective installations with other project disciplines.

#### 3.2 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
  1. Coordinate electrical systems, equipment, and materials installation with other building components. Electrical plans and details do not show all interferences and conditions, visible and/or hidden, that may exist. Before selecting material and equipment, and proceeding with work, inspect areas where material and equipment are to be installed to insure suitability, and check needed space for placements, clearances and interconnections. Before cutting or drilling into building elements inspect and layout work to avoid damaging structural elements or building utilities.
  2. Electrical plans, details, and diagrams show the general location and arrangement of electrical systems. They are diagrammatic and do not show all conduit bodies, connectors, bends, fittings, hangers, and additional pull and junction boxes which the Contractor must provide to complete the electrical system.
  3. Verify all dimensions by field measurements.
  4. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
  5. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  6. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building. Verify dimensional constraints of building door openings and passageways, and

- the maximum floor loadings, for the movement of selected material and equipment. Order equipment and material, broken down as may be required, to meet these constraints.
7. Measurement from above finished floor (AFF) shall be taken from the finished floor surface to the top of wall receptacles and switch boxes, to the centerline of wall lighting outlet boxes, to the top of wall mounted equipment enclosures, to the centerline of top most switch handle, or to the lowest surface of ceiling lighting fixtures and other ceiling mounted equipment.
    - a. Unless otherwise indicated, wall switch boxes shall be 44 inches AFF. Refer to Architectural Drawings.
    - b. Unless otherwise indicated, receptacle boxes shall be 18 inches AFF. Receptacle mounted above counter and at furniture locations shall be coordinated with architectural elements. Refer to Architectural Drawings. Coordinate with Architect.
  8. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible. Switch and receptacle heights shall meet handicap accessible code requirements.
  9. Coordinate connection of electrical systems with incoming utilities and services. Comply with requirements of governing regulations, power, telephone, and data service companies, and controlling agencies. Provide required connection for each service. Provide power connection to equipment. Coordinate with other Divisions.
  10. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. 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 Engineer.
  11. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
  12. Conduit Sizing:
    - a. Unless otherwise indicated, conduit size for indicated conductor shall be based on Chapter 9 of NEC.
    - b. Conduit: 1/2 inch minimum size.
  13. Install electrical 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. Measure and locate placement of equipment and materials in relation to building structure and surfaces, and between equipment to be installed and wired. Maintain required minimum access spacing for equipment and enclosures.
  14. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified elsewhere.



15. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
16. Unless otherwise noted, individual raceway runs are required for each kitchen equipment component. Connection shall be routed down existing walls exposed, concealed in new walls, and/or under slab to the respective area as noted.

### 3.3 PERMITS AND INSPECTIONS

- A. Obtain and pay for all required permits and arrange for all required inspections in accordance with state and local governing authorities.
- B. Final Electrical Inspection Certificate from inspection agency or governing authority.

### 3.4 FIELD QUALITY CONTROL

- A. Perform field tests as specified under other electrical sections.
- B. Arrange for local Inspection Authorities to inspect work performed prior to burial, closing-in behind wall and above ceiling, or encased in concrete. Also arrange for final inspection of work and obtain Final Inspection Certificate before final inspection of work by Owner or his representative.

### 3.5 PROTECTION

- A. Protect personnel from coming in contact with live parts.
- B. During remodeling or alteration work, maintain fire ratings of walls, floors and ceilings when work is left unattended.
- C. Protect from damage and theft equipment and materials provided or supplied by others in accordance with manufacturer's recommendation and warranties, and with electrical standards and practices.

### 3.6 ADDITIONAL WORK

- A. Provide lighting systems including emergency lighting.
- B. Provide power and control wiring for Mechanical equipment.

### 3.7 ELECTRICAL SCHEDULES

- A. As specified in related sections or shown on drawings.

### 3.8 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 1. In addition to the requirements specified in Division 1, the following requirements apply:
  1. Perform cutting, fitting, and patching of electrical 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 Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
  3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
  4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
  5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
  6. 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.
  7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 16010

## SECTION 16050 – BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes limited scope general construction materials and methods for application with electrical installations as follows:
  - 1. Miscellaneous metals for support of electrical materials and equipment.
  - 2. Fire rated wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment.
  - 3. Joint sealers for sealing around electrical materials and equipment; and for sealing penetrations in fire and smoke barriers, floors, and foundation walls.
  - 4. Access panels and doors in walls, ceilings, and floors for access to electrical materials and equipment.

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for the following products:
  - 1. Access panels and doors.
  - 2. Joint sealers.
- C. Shop drawings detailing fabrication and installation for metal fabrications, and wood supports and anchorage for electrical materials and equipment.
- D. Coordination drawings for access panel and door locations in accordance with Division 16 Section "Basic Electrical Requirements."
- E. Samples of joint sealer, consisting of strips of actual products showing full range of colors available for each product.
- F. Welder certificates, signed by Contractor, certifying that welders comply with requirements specified under "Quality Assurance" article of this Section.

- G. Schedules indicating proposed methods and sequence of operations for selective demolition prior to commencement of Work. Include coordination for shut off of electrical service, and details for dust and noise control.
  - 1. Coordinate sequencing with construction phasing and Owner occupancy as specified in other Divisions.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer for the installation and application of joint sealers, access panels, and doors.
- B. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code Steel."
  - 1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
- C. Fire Resistance Ratings: Where a fire resistance classification is indicated, provide access door assembly with panel door, frame, hinge, and latch from manufacturer listed in the UL "Building Materials Directory" for rating shown.
  - 1. Provide UL Label on each fire rated access door.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver joint sealer materials 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.
- B. Store and handle joint sealer materials in compliance with the manufacturers' recommendations to prevent their deterioration and damage.

#### 1.6 PROJECT CONDITIONS

- A. Conditions Affecting Selective Demolition: The following project conditions apply:
  - 1. Protect adjacent materials indicated to remain or in the other phases of the proposed construction. Install and maintain dust and noise barriers to keep dirt, dust, and noise from being transmitted to adjacent areas. Remove protection and barriers after demolition operations are complete.
  - 2. Locate, identify, and protect electrical services passing through demolition area and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services for affected areas.
  - 3. Arrange for electric service change-overs during periods when the building is not occupied. This may include week-ends and evening hours. Coordinate with Owner's representatives.

- B. Environmental Conditions: Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.

#### 1.7 SEQUENCE AND SCHEDULING

- A. Coordinate the shut off and disconnection of electrical power with the Owner.
- B. Notify the Engineer at least 5 days prior to commencing demolition operations.
- C. Perform demolition in sequencing/phases as noted and as required.

### PART 2 - PRODUCTS

#### 2.1 MISCELLANEOUS METALS

- A. Steel plates, shapes, bars, and bar grating: ASTM A 36.
- B. Cold Formed Steel Tubing: ASTM A 500.
- C. Hot Rolled Steel Tubing: ASTM A 501.
- D. Steel Pipe: ASTM A 53, Schedule 40, welded.
- E. Nonshrink, Nonmetallic Grout: Premixed, factory packaged, nonstaining, noncorrosive, nongaseous grout, recommended for interior and exterior applications.
- F. Fasteners: Zinc coated, type, grade, and class as required.

#### 2.2 MISCELLANEOUS LUMBER

- A. Framing Materials: Standard Grade, light framing size lumber of any species. Number 3 Common or Standard Grade boards complying with WCLIB or AWPB rules, or Number 3 boards complying with SPIB rules. Lumber shall be preservative treated in accordance with AWPB LP 2, and kiln dried to a moisture content of not more than 19 percent.
- B. Construction Panels: Plywood panels; APA C D PLUGGED INT, with exterior glue; thickness as indicated, or if not indicated, not less than 3/4 inches.

#### 2.3 JOINT SEALER

- A. General: Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
- B. Colors: As selected by the Architect from manufacturer's standard colors.

- C. Elastomeric Joint Sealers: Provide the following types:
1. One part, nonacid curing, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non traffic areas for masonry, glass, aluminum, and other substrates recommended by the sealant manufacturer.
  2. One part, mildew resistant, silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25, for uses in non traffic areas for glass, aluminum, and nonporous joint substrates; formulated with fungicide; intended for sealing interior joints with nonporous substrates; and subject to in service exposure to conditions of high humidity and temperature extremes.
  3. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
    - a. One Part, Nonacid Curing, Silicone Sealant:
      - 1) Bostik - "Chem Caulk 2000"
      - 2) Dow Corning - "Dow Corning 790"
      - 3) Pecora Corp – "864NST"
    - b. One Part, Mildew Resistant, Silicone Sealant:
      - 1) Dow Corning - "Dow Corning 786"
      - 2) GE - "SCS 1702"
      - 3) Pecora Corp. - "898"
- D. Acrylic Emulsion Sealants: One part, nonsag, mildew resistant, paintable complying with ASTM C 834 recommended for exposed applications on interior and protected exterior locations involving joint movement of not more than plus or minus 5 percent.
1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
    - a. Bostik - "Chem Caulk 600"
    - b. Pecora Corp. - "AC 20"
    - c. Tremco – "Tremflex 834"
- E. Fire Resistant Joint Sealers: Two part, foamed in place, silicone sealant formulated for use in through penetration fire stopping around cables, conduit, pipes, and duct penetrations through fire rated walls and floors. Sealants and accessories shall have fire resistance ratings indicated, as established by testing identical assemblies in accordance with ASTM E 814, by Underwriters' Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
  - a. Dow Corning - "Dow Corning Fire Stop Foam"
  - b. GE - "Pensil 851"
  - c. Hilti – "CP-620 Fire Stop Foam"

## 2.4 ACCESS DOORS

- A. Steel Access Doors and Frames: Factory fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
- B. Frames: 16 gage steel, with a 1 inch wide exposed perimeter flange for units installed in unit masonry, pre cast, or cast in place concrete, ceramic tile, or wood paneling.
  1. For installation in masonry, concrete, ceramic tile, or wood paneling: 1 inch wide exposed perimeter flange and adjustable metal masonry anchors.
  2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
  3. For full bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
- C. Flush Panel Doors: 14 gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory applied prime paint.
  1. Fire Rated Units: Insulated flush panel doors, with continuous piano hinge and self closing mechanism.
- D. Locking Devices: Flush, screwdriver operated cam locks.
- E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
  1. Bar Co., Inc.
  2. J.L. Industries.
  3. Karp Associates, Inc.
  4. Milcor Div. Inryco, Inc.
  5. Nystrom, Inc.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and application of joint sealers and access panels. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION FOR JOINT SEALER

- A. Surface Cleaning for Joint Sealers: Clean surfaces of joints immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
- B. Apply joint sealer primer to substrates as recommended by joint sealer manufacturer. Protect adjacent areas from spillage and migration of primers, using masking tape. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 ERECTION OF METAL SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place miscellaneous metal fabrications accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. Field Welding: Comply with AWS "Structural Welding Code."

### 3.4 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. 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.
- C. Attach to substrates as required to support applied loads.
- D. Do not install wood materials in areas being utilized as air plenum or other spaces where a potential combustible hazard exists.

### 3.5 APPLICATION OF JOINT SEALERS

- A. General: Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
  - 1. Comply with recommendations of ASTM C 962 for use of elastomeric joint sealants.
  - 2. Comply with recommendations of ASTM C 790 for use of acrylic emulsion joint sealants.



- B. Tooling: Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- C. Installation of Fire Stopping Sealant: Install sealant, including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide fire stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

### 3.6 INSTALLATION OF ACCESS DOORS

- A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.
- B. Adjust hardware and panels after installation for proper operation.

END OF SECTION 16050

## SECTION 16060 – ELECTRICAL DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. 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 16.

#### 1.1 DESCRIPTION OF WORK

- A. Demolish designated and required elements of existing electrical system.
- B. Removal of materials from site.
- C. Rework of existing electrical system for interface to new systems and equipment.

#### 1.2 EXISTING CONDITIONS

- A. Conduct electrical demolition to avoid existing system damage scheduled to remain. Interface with adjoining building elements.
- B. The scope of electrical demolition shall include but not limited to the following:
  - 1. Electrical equipment, lighting, raceways and wiring made obsolete by this installation.
- C. Conduct operations with minimum interference to existing systems serving other buildings.

### PART 2 - PRODUCTS – NOT USED

### PART 3 - EXECUTION

#### 1.1 PREPARATION

- A. Protect existing systems and components, which are not to be demolished.
- B. Protect existing items, which are not indicated to be altered.
- C. Provide and locate dumpster where directed by Agency.

#### 1.2 EXECUTION

- A. Demolish in an orderly and careful manner.
- B. Except where noted otherwise, immediately remove demolished materials from site.
- C. Cease operations and notify Engineer immediately if adjacent systems appear to be endangered. Do not resume operations until corrective measures have been

taken.

- D. Do not burn or bury materials on site.
- E. Remove designated electrical systems and equipment as noted above and in accordance with the Contract Documents, and Electrical Drawings.
- F. Where penetrations through walls are to be closed and patched, both sides of wall shall be closed and patched
- G. Removed demolished materials from site as work progresses. Leave site in clean condition.
- H. Remove dumpster and clean and repair to original condition.

END OF SECTION 16060

## SECTION 16110 – RACEWAYS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes raceways for electrical wiring. Types of raceways in this section include the following:
  - 1. Rigid metal conduit.
  - 2. Intermediate metal conduit.
  - 3. Liquidtight flexible conduit.
  - 4. Flexible metal conduit.
  - 5. Electrical Metallic Tubing (EMT).
  - 6. Rigid nonmetallic conduit.
  - 7. Wireways.
- B. This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:
  - 1. Outlet and device boxes.
  - 2. Pull and junction boxes.
  - 3. Cabinets.
  - 4. Hinged door enclosures.
- C. Related Sections: The following Division 16 Sections contain requirements that relate to this Section:
  - 1. "Wires and Cables" for other wiring methods.
  - 2. "Supporting Devices" for raceway supports.

#### 1.3 DEFINITIONS

- A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.
- B. Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.
- C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.

- D. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.
- E. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
  - 1. Product data for Raceway systems.
  - 2. Product data for cabinets and enclosures with classification higher than NEMA 1.
  - 3. Shop drawings for boxes, enclosures and cabinets that are to be shop fabricated, (nonstock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.

#### 1.5 QUALITY ASSURANCE

- A. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
- B. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this section shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
- C. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."
- D. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."
- E. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- F. Provide raceway products and components listed and labeled by UL, ETL, or CSA.

#### 1.6 SEQUENCING AND SCHEDULING

- A. Coordinate with other Work, including metal and concrete deck installation, as necessary to interface installation of electrical raceways and components with other Work.

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  
- B. Conduit Bodies:
  - 1. Appleton Electric Co.
  - 2. Carlon
  - 3. Killark Electric Mfg. Co.
  - 4. O Z/Gedney
  - 5. Spring City Electrical Mfg. Co.
  
- C. Wireways:
  - 1. Erickson Electric Equipment Co.
  - 2. GS Metals Corp.
  - 3. Hoffman Engineering Co.
  
- D. Cabinets:
  - 1. Erickson Electrical Equipment Co.
  - 2. Hoffman Engineering Co.
  - 3. Spring City Electrical Mfg. Co.
  - 4. Square D Co.

## 2.2 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
  
- B. Intermediate Steel Conduit: UL 1242.
  
- C. Electrical Metallic Tubing and Fittings: ANSI C80.3
  
- D. Flexible Metal Conduit: UL 1, zinc coated steel.
  
- E. Liquid-tight Flexible Metal Conduit and Fittings: UL 360. Fittings shall be specifically approved for use with this raceway.

## 2.3 NONMETALLIC CONDUIT AND DUCTS

- A. Rigid Nonmetallic Conduit: NEMA TC 2 and UL 651, Schedule 40 or 80 PVC.
  
- B. PVC Conduit and Tube Fittings: TC 3; match to conduit or conduit/tube type and material.
  
- C. Conduit, Tubing and Duct Accessories: Types, sizes and materials complying with manufacturer's published product information. Match and ,atch to raceway.

## 2.4 CONDUIT BODIES

- A. General: Types, shapes, and sizes as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion resistant screws.
- B. Metallic Conduit and Tubing: Use metallic conduit bodies. Use bodies with threaded hubs for threaded raceways.
- C. Conduit Bodies 1 Inch and Smaller: Use bodies with compression type threaded connectors.
- D. Nonmetallic Conduit and Tubing: Use nonmetallic conduit bodies conforming to UL 514B

## 2.5 WIREWAYS

- A. General: Electrical wireways shall be of types, sizes, and number of channels indicated. Fittings and accessories including but not limited to couplings, offsets, elbows, expansion joints, adapters, hold-down straps, and end caps shall match and mate with wireway as required for completed system. Where features are not indicated, select to fulfill wiring requirements and comply with applicable provisions of NEC.
- B. Wireway covers to be hinged type.

## 2.6 CABINETS, BOXES, AND FITTINGS, GENERAL

- A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations. This applies to kitchen areas.
- B. Materials and finish
  - 1. Sheet Steel: Flat rolled, code gage, galvanized steel.
  - 2. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
  - 3. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
  - 4. Cast Metal for Boxes, Enclosures, and Covers; Copper free aluminum except as otherwise specified.
  - 5. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
  - 6. Painted Interior Finish: Where indicated, white baked enamel.
  - 7. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

## 2.7 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
- C. Cast Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

## 2.8 PULL OR JUNCTION BOXES

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot dip galvanized after fabrication. Cover shall be gasketed.
- D. Stainless Steel Boxes: Fabricate of stainless steel conforming to Type 302 of ASTM A 167, "Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip." Where necessary to provide a rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.
- E. Cast Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

## 2.9 CABINETS

- A. Comply with UL 50, "Electrical Cabinets and Boxes."
- B. Construction: Sheet steel, NEMA 4 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door



hinges not over 24 inches apart and not over 6 inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.

- C. Doors: Double doors for cabinets wider than 24 inches.
- D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

## 2.10 STEEL ENCLOSURES WITH HINGED DOORS

- A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6,
- B. "Enclosures for Industrial Controls and Systems."
- C. Construction: Sheet steel, 16 gage, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.
- D. Doors: Hinged directly to cabinet and removable, with approximately 3/4 inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24 inches. Provide multiple doors where required.
- E. Mounting Panel: Provide painted removable internal mounting panel for component installation.
- F. Enclosure: NEMA 4 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

## PART 3 - EXECUTION

### 3.1 RACEWAY WIRING METHOD

- A. Outdoors: Use the following wiring methods:
  - 1. Exposed / Concealed: Rigid metal conduit, Intermediate metal conduit.
  - 2. Underground: Rigid metal conduit, Rigid nonmetallic conduit.
  - 3. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic, or electric solenoid or motor driven equipment: liquidtight flexible metal conduit. Maximum length six (6) feet.

- B. Indoors: Use the following wiring methods:
1. Connection to Vibrating Equipment: Including transformers and hydraulic, pneumatic or electric solenoid or motor operated equipment: Flexible metal conduit. Maximum length six (6) feet.
  2. Exposed/Concealed branch circuits: EMT.
  3. Exposed/Concealed panelboard feeders: Intermediate metal conduit, Rigid metal conduit.
  4. Connection to vibrating equipment and hydraulic, pneumatic, or electric solenoid or motor driven equipment in moist or humid location or corrosive atmosphere, or where subject to water spray or dripping oil, grease, or water: Liquidtight flexible metal conduit. Maximum length six (6) feet.
  5. All conduits within finished areas shall be concealed.

### 3.2 RACEWAY INSTALLATION

- A. General: Install electrical raceways in accordance with manufacturer's written installation instructions, applicable requirements of NEC, and as follows:
- B. Conceal Conduit, unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and hot water pipes. Install raceways level and square and at proper elevations.
- C. Elevation of Raceway: Where possible, install horizontal raceway runs above water and sanitary piping.
- D. Complete installation of electrical raceways before starting installation of conductors within raceways.
- E. Provide supports for raceways as specified elsewhere in Division 16.
- F. Prevent foreign matter from entering raceways by using temporary closure protection.
- G. Protect stub ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- H. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- I. Use raceway fittings that are of types compatible with the associated raceway and suitable for the use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings except as otherwise indicated.

- J. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.
- K. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
- L. Run exposed, parallel, or banked raceways together. Make bends in parallel or banked runs from the same center line so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel. This requires that there be a change in the plane of the run such as from wall to ceiling and that the raceways be of the same size. In other cases provide field bends for parallel raceways.
- M. Join raceways with fittings designed and approved for the purpose and make joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors.
- N. Tighten set screws of threadless fittings with suitable tool.
- O. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
- P. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- Q. Install pull wires in empty raceways. Use no. 14 AWG zinc coated steel or monofilament plastic line having not less than 200 lb tensile strength. Leave not less than 12 inches of slack at each end of the pull wire.
- R. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
  - 1. Where conduits pass from warm locations to cold locations, such as the boundaries of conditioned spaces and mechanical spaces.
  - 2. Where required by the NEC.

- S. Stub up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches above the floor.
- T. Flexible Connections: Use short length (maximum of 6 ft.) of flexible conduit for recessed and semirecessed lighting fixtures, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet locations. Install separate ground conductor across flexible connections. Light fixture flexible connections shall not exceed 15 ft.

### 3.3 CABINETS AND BOXES INSTALLATION, GENERAL

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.
- B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- C. Support and fasten items securely in accordance with Division 16 Section "Supporting Devices."
- D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
- E. Remove sharp edges where they may come in contact with wiring or personnel.

### 3.4 APPLICATIONS

- A. Cabinets: Flush mounted, NEMA enclosure Type 1 except as otherwise indicated.
- B. Hinged Door Enclosures: NEMA Type 1 enclosure except as indicated.
- C. Hinged Door Enclosures Outdoors: Install drip hood, factory tailored to individual units.
- D. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:
  - 1. Interior Dry Locations: NEMA Type 1, sheet steel or as permitted by local code.
  - 2. Locations Exposed to Weather, Dampness, or Wet Locations: NEMA Type 3R enclosures.

- E. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

### 3.5 INSTALLATION OF OUTLET BOXES

- A. Outlets at Windows and Doors: Locate close to window trim.
- B. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.
- C. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.
- D. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:
  - 1. Exterior locations.
  - 2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
  - 3. Where exposed to moisture laden atmosphere.
  - 4. Where indicated.
- E. Cast Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.
- F. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally but consistently either way. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.
- G. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4 inches square by 1 1/2 inches deep, minimum.
- H. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.
- I. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

### 3.6 INSTALLATION OF PULL OR JUNCTION BOXES

- A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8 inches square by 4 inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

Size of Largest Conductors in Box	Maximum no. of Conductors in Box
No. 4/0 AWG	30
250 MCM	20
500 MCM	15
Over 500 MCM	10

1. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
2. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.
3. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

### 3.7 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

- A. Mount with fronts straight and plumb.
- B. Install with tops 78 inches above floor.
- C. Set cabinets in finished spaces flush with walls.

### 3.8 GROUNDING

- A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

### 3.9 RACEWAY ADJUSTING AND CLEANING

- A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt, and construction debris.

3.10 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.
  
- B. Galvanized Finish: Repair damage using a zinc rich paint recommended by the tray manufacturer.
  
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch up coating.

END OF SECTION 16110

## SECTION 16120 – WIRES AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of other specified Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes wires, cables, and connectors for power, lighting, signal, control and related systems rated 600 volts and less.

#### 1.3 SUBMITTALS

- A. Product Data for electrical wires, cables and connectors.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following code:
  - B. NFPA 70 "National Electrical Code."
    - 1. Conform to applicable codes and regulations regarding toxicity of combustion products of insulating materials.
  - C. UL Compliance: Provide components which are listed and labeled by UL under the following standards.
    - 1. UL Std. 83 Thermoplastic-Insulated Wires and Cables.
    - 2. UL Std. 486A Wire Connectors and Soldering Lugs for Use with Copper Conductors.
    - 3. UL Std. 1569 Metal Clad Cable.
  - D. NEMA/ICEA Compliance: Provide components which comply with the following standards:
    - 1. WC-5 Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
  - E. IEEE Compliance: Provide components which comply with the following standard.
    - 1. Std. 82 Test procedures for Impulse Voltage Tests on Insulated Conductors.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS



- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. Wire and Cable:
    - a. American Insulated Wire Corp.
    - b. Republic Wire Inc.
    - c. Southwire Company.
  - 2. Connectors for Wires and Cable Conductors:
    - a. AMP
    - b. 3M Company
    - c. O-Z/Gedney Co.
    - d. Square D Company.

## 2.2 WIRES AND CABLES

- A. General: Provide wire and cable suitable for the temperature, conditions and location where installed.
- B. Conductors: Provide stranded conductors for power and lighting circuits no. 10 AWG and smaller. Provide stranded conductors for sizes no. 8 AWG and larger.
- C. Conductor Material: copper for all wires and cables.
- D. Conductor sizes indicated are based on copper.
- E. Insulation: Provide THHN/THWN-2 insulation for all conductors size 500MCM and larger, and no. 8 AWG and smaller. For all other sizes provide, THHN/THWN-2 or XHHW insulation as appropriate for the locations where installed.
- F. Color Coding for phase identification in accordance with Table 1 in Part 3 below.
- G. Jackets: Factory-applied nylon or PVC external jacketed wires and cables for pulls in raceways over 100-feet in length, for pulls in raceways with more than three equivalent 90 deg. bends, for pulls in conduits underground or under slabs on grade, and where indicated.
- H. Cables: Provide the following type(s) of cables in NEC approved locations and applications where indicated. Provide cable UL listed for particular application:
  - 1. Metal-Clad Cable: Type MC - limited to the following:
    - a. Lighting fixtures and outlets concealed in gypsum wallboard partitions.

## 2.3 CONNECTORS FOR CONDUCTORS

- A. Provide UL-listed factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperature ratings equal to or greater than those of the wires upon which used.

## PART 3 - EXECUTION

### 3.1 WIRING METHOD

- A. Use the following wiring methods as indicated:
  - 1. Wire: install all wire in raceway.
  - 2. Metal Clad Cable, Type MC: where wiring concealed in gypsum wall partitions, ceilings, for connections from raceway outlet boxes to lighting fixtures, unless otherwise noted.

### 3.2 INSTALLATION OF WIRES AND CABLES

- A. General: Install electrical cables, wires, and connectors in compliance with NEC.
- B. Coordinate cable installation with other Work.
- C. Pull conductors simultaneously where more than one is being installed in same raceway. Use UL listed pulling compound or lubricant, where necessary.
- D. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceways. Do not use rope hitches for pulling attachment to wire or cable.
- E. Conceal all cable in finished spaces.
- F. Keep conductor splices to minimum.
- G. Install splice and tap connectors which possess equivalent or better mechanical strength and insulation rating than conductors being spliced.
- H. Use splice and tap connectors which are compatible with conductor material.
- I. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than no 10 AWG cabled in individual circuits. Make terminations so there is no bare conductor at the terminal.
- J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where

manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

### 3.3 FIELD QUALITY CONTROL

- A. Prior to energizing, check installed wires and cables with megohm meter to determine insulation resistance levels to assure requirements are fulfilled.
- B. Prior to energizing, test wires and cables for electrical continuity and for short-circuits.
- C. Subsequent to wire and cable hook-ups, energize circuits and demonstrate proper functioning. Correct malfunctioning units, and retest to demonstrate compliance.
- D. TABLE 1: Color Coding for Phase Identification:
  - 1. Color code secondary service, feeder, and branch circuit conductors with factory applied color as follows:

<u>208Y/120Volts</u>	<u>Phase</u>	<u>120/240Volts</u>
Black	A	Black
Red	B	Red
Blue	C	-
White	Neutral	White
Green	Ground	Green

END OF SECTION 16120

## SECTION 16135 – CABINETS, BOXES AND FITTINGS

### PART 1- GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this Section include:
  - 1. Outlet and device boxes.
  - 2. Pull and junction boxes.
  - 3. Cabinets.
  - 4. Hinged door enclosures.
- B. Conduit-body-type electrical enclosures and wiring fittings are specified in Division 16 Section "Raceways."

#### 1.3 DEFINITIONS

- A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.
- B. Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.
- C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.
- D. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.
- E. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or of switches for controlling electrical circuits.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:
  - 1. Product data for cabinets and enclosures with classification higher than NEMA 1.
  - 2. Shop drawings for boxes, enclosures and cabinets that are to be shop fabricated, (nonstock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent

equipment. Show box types, dimensions, and finishes.

### 1.5 QUALITY ASSURANCE

- A. UL Listing and Labeling: Items provided under this section shall be listed and labeled by UL.
- B. Nationally Recognized Testing Laboratory Listing and Labeling (NRTL): Items provided under this section shall be listed and labeled by a NRTL. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.
- C. National Electrical Code Compliance: Components and installation shall comply with NFPA 70 "National Electrical Code."
- D. NEMA Compliance: Comply with NEMA Standard 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Cabinets:
    - a. Electric Panelboard, Inc.
    - b. Erickson Electrical Equipment Co.
    - c. Hoffman Engineering Co.
    - d. Parker Electrical Mfg. Co.
    - e. Spring City Electrical Mfg. Co.
    - f. Square D Co.

### 2.2 CABINETS, BOXES, AND FITTINGS, GENERAL

- A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers and accessories required for the intended use. Provide gaskets for units in damp or wet locations. This also applies to the exterior applications.

### 2.3 MATERIALS AND FINISHES

- A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
- B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
- C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.

- D. Cast Metal for Boxes, Enclosures, and Covers; Copper-free aluminum except as otherwise specified.
- E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
- F. Painted Interior Finish: Where indicated, white baked enamel.
- G. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connectors.

#### 2.4 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES

- A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application.
- B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be sheet steel with stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior rings and fixture studs.
- C. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

#### 2.5 PULL OR JUNCTION BOXES

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.
- D. Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 302 of ASTM A 167, "Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip." Where necessary to provide a rigid assembly, construct with internal structural stainless steel bracing. Cover shall be gasketed.
- E. Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

## 2.6 CABINETS

- A. Comply with UL 50, "Electrical Cabinets and Boxes."
- B. Construction: Sheet steel, NEMA 4 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24-inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24-inches apart and not over 6-inches from top and bottom of door. For flush cabinets, make the front approximately 3/4 inch larger than the box all around. For surface mounted cabinets make front same height and width as box.
- C. Doors: Double doors for cabinets wider than 24-inches.
- D. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical-electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

## 2.7 STEEL ENCLOSURES WITH HINGED DOORS

- A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6,
- B. "Enclosures for Industrial Controls and Systems."
- C. Construction: Sheet steel, 16 gage, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.
- D. Doors: Hinged directly to cabinet and removable, with approximately 3/4-inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24-inches. Provide multiple doors where required.
- E. Mounting Panel: Provide painted removable internal mounting panel for component installation.
- F. Enclosure: NEMA 4 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions.

- B. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.
- C. Support and fasten items securely in accordance with Division 16 Section "Supporting Devices."
- D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.
- E. Remove sharp edges where they may come in contact with wiring or personnel.

### 3.2 APPLICATIONS

- A. Cabinets: Flush mounted, NEMA enclosure Type 1 except as otherwise indicated.
- B. Hinged Door Enclosures: NEMA Type 1 enclosure except as indicated.
- C. Hinged Door Enclosures Outdoors: Install drip hood, factory tailored to individual units.
- D. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:
  - 1. Interior Dry Locations: NEMA Type 1, sheet steel or as permitted by local code.
  - 2. Locations Exposed to Weather, Dampness, or Wet Locations: NEMA Type 3R enclosures.
- E. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

### 3.3 INSTALLATION OF OUTLET BOXES

- A. Outlets at Windows and Doors: Locate close to window trim.
- B. Column and Pilaster Locations: Locate outlet boxes for switches and receptacles on columns or pilasters so the centers of the columns are clear for future installation of partitions.
- C. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.



- D. Gasketed Boxes: At the following locations use cast metal, threaded hub type boxes with gasketed weatherproof covers:
  - 1. Exterior locations.
  - 2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
  - 3. Where exposed to moisture laden atmosphere.
  - 4. Where indicated.
- E. Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.
- F. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles either vertically or horizontally but consistently either way. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side.
- G. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4-inches square by 1-1/2-inches deep, minimum.
- H. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.
- I. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.

### 3.4 INSTALLATION OF PULL OR JUNCTION BOXES

- A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8-inches square by 4-inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

Size of Largest Conductors in Box	Maximum no. of Conductors in Box
No. 4/0 AWG	30
250 MCM	20
500 MCM	15
Over 500 MCM	10

- 1. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at

- least every 30-inches inside boxes.
- 2. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling.
- 3. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

### 3.5 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES

- A. Mount with fronts straight and plumb.
- B. Install with tops 78-inches above floor.
- C. Set cabinets in finished spaces flush with walls.

### 3.6 GROUNDING

- A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

### 3.7 CLEANING AND FINISH REPAIR

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.
- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.
- C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION - 16135

## SECTION 16143 – WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 16 Sections apply to this section:
  - 1. Common Work Results for Electrical.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Receptacles
  - 2. Ground Fault Circuit Interrupter Receptacles
  - 3. Snap Switches
  - 4. Wall Plates
  - 5. Occupancy Sensors
- B. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 16 Section "Enclosed Switches and Circuit Breakers" for devices other than snap switches and plug/receptacle sets used as disconnects for motors.

#### 1.3 SUBMITTALS

- A. Product data for each type of product specified.
- B. Samples of those products indicated for sample submission in Architect's comments on product data submittal. Include color and finish samples of device plates and other items per Architect's request.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with provisions of the following codes.
- B. NFPA 70 "National Electrical Code".
  - 1. UL and NEMA Compliance: Provide wiring devices which are listed and labeled by UL and comply with applicable UL and NEMA standards.

#### 1.5 SEQUENCE AND SCHEDULING

- A. Schedule installation of finish plates after the surface upon which they are installed has received final finish.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to specifications and 'Buy American' ARRA compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Cooper Wiring Devices
  2. Hubbell Inc.
  3. Leviton
  4. Legrand (Pass and Seymour)

### 2.2 WIRING DEVICES:

- A. General: Provide wiring devices, in types, characteristics, grades, colors, and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL and NEMA standards. Provide ivory color devices and wall plates except as otherwise indicated. Verify color selections with Architect.
- B. Receptacles: As scheduled in Table 1 in Part 3 below. Comply with UL 498 and NEMA WD 1.
- C. Ground-Fault Circuit Interrupter (GFCI) Receptacles: As indicated in Table 1 in Part 3 below; provide "feed-thru" type ground-fault circuit interrupter, with integral heavy-duty NEMA 5-20R duplex receptacles arranged to protect connected downstream receptacles on same circuit. Provide unit designed for installation in a 2-3/4 inch deep outlet box without adapter, grounding type, Class A, Group 1, per UL Standard 94.3.
- D. Snap Switches: quiet type AC switches as indicated in Table 2 in Part 3 below. Comply with UL 20 and NEMA WD1.
- E. Occupancy Sensors (ceiling): Multi-Technology, 360 degree self adjusting ceiling-mounted occupancy sensor. All sensors shall have ready accessible and user adjustable time delay and sensitivity controls. All sensors shall contain manual bypass. 2000 square foot coverage area. Provide appropriate power packs as required for installation.
- F. Occupancy Sensors (wall switch): multi-Technology, 180 degree self adjusting wall switch -mounted occupancy sensor. All sensors shall have ready accessible and user adjustable time delay and sensitivity controls. All sensors shall contain manual bypass.

### 2.3 WIRING DEVICE ACCESSORIES

- A. Wall plates: single and combination, of types, sizes, and with ganging and cutouts as indicated. Provide plates which mate and match with wiring

devices to which attached. Provide metal screws for securing plates to devices with screw heads colored to match finish of plates. Provide wall plate color to match wiring devices except as otherwise indicated. Provide plates possessing the following additional construction features:

1. Material and Finish: steel plate, galvanized, for building mechanical spaces.
2. Material and Finish: plastic, smooth, for tenant spaces, and other finished areas.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF WIRING DEVICES AND ACCESSORIES:

- A. Install wiring devices and accessories as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other Work, including painting, electrical boxes and wiring installations, as necessary to interface installation of wiring devices with other Work.
- C. Install wiring devices only in electrical boxes which are clean; free from building materials, dirt, and debris.
- D. Install galvanized steel wallplates in unfinished spaces.
- E. Install wiring devices after wiring work is completed.
- F. Install wall plates after painting work is completed.
- G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486. Use properly scaled torque indicating hand tool.

#### 3.2 PROTECTION

- A. Protect installed components from damage. Replace damaged items prior to final acceptance.

#### 3.3 FIELD QUALITY CONTROL

- A. Testing: Prior to energizing circuits, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energizing, test wiring devices and demonstrate compliance with requirements, operating each operable device at least six times.

B. Test ground fault interruptor operation with both local and remote fault simulations in accordance with manufacturer recommendations.

C. TABLE 1

RECEPTACLES

DESIG- NATION (1)	CURRENT RATING AMPS	VOLTAGE RATING	SINGLE/ DUPLEX	NEMA CONFIG- URATION	UL GRADE	NOTES
-	20	125	DUPLEX	5-20R	SPECIFICATION GRADE	
GFCI	20	125	DUPLEX	5-20R	SPECIFICATION GRADE	INTEGRAL GFCI
GFCI WP	20	125	DUPLEX	5-20R	SPECIFICATION GRADE	INTEGRAL GFCI WEATHER- PROOF

NOTES

(1) Letter designations are used where symbols alone do not clearly designate on plans locations where specific receptacle types are used.

D. TABLE 2

SNAP SWITCHES

DESIG- NATION (1)	TYPICAL APPLICATION	VOLTAGE LOAD RATING (AC)	RATING	POLES	UL GRADE	NOTES
S	CONTROL LIGHTS	20A	120/277	1	HEAVY DUTY	-
S3	CONTROL - LIGHTS	20A	120/277	3-way	HEAVY DUTY	
S	DISCONN. MOTOR	1HP	120/277	1	HEAVY DUTY	(2)
STOL	DISCONN. MOTOR	2HP	208/480	3	HEAVY DUTY	(2)

NOTES

- (1) For snap switches, designation is the same as the symbol used on plans for the device. Type of switch is determined from plan context including type of device or circuit being controlled.
- (2) With overload element in switch.

END OF SECTION 16143

## SECTION 16170 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. Requirements specified in other Division 26 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes circuit and motor disconnects.

#### 1.3 SUBMITTALS

- A. Product data for each type of product specified.
- B. Maintenance data for circuit and motor disconnects, for inclusion in Operation and Maintenance Manual specified in Division 1 and Division 16 Section "Basic Electrical Requirements."

#### 1.4 QUALITY ASSURANCE

- A. Electrical Component Standards: Provide components complying with NFPA 70 "National Electrical Code" and which are listed and labeled by UL. Comply with UL Standard 98 and NEMA Standard KS 1.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. Appleton
  - 2. Crouse-Hinds Co.
  - 3. Eaton Corp.
  - 4. Square D Company.

#### 2.2 CIRCUIT AND MOTOR DISCONNECT SWITCHES

- A. General: Provide circuit and motor disconnect switches in types, sizes, duties, features ratings, and enclosures as indicated. Provide NEMA 1 enclosure except for outdoor switches, and other indicated locations provide NEMA 3R enclosures with raintight hubs. For motor and motor starter disconnects, provide units with horsepower ratings suitable to the loads.



- B. Fusible Switches: Heavy duty switches, with fuses of classes and current ratings indicated. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses.
- C. Non-fusible Disconnects: Heavy duty switches of classes and current ratings as indicated.
- D. Double-Throw Switches: Heavy duty switches of classes and current ratings as indicated.
- E. Provide weatherproof, NEMA Type 3R rated enclosures at exterior and wet/damp locations.

### 2.3 ACCESSORIES

- A. Electrical Interlocks: Provide number and arrangement of interlock contacts in switches as indicated.
- B. Captive Fuse Pullers: Provide built-in fuse pullers arranged to facilitate fuse removal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF CIRCUITS AND MOTOR DISCONNECTS

- A. General: Provide circuit and motor disconnect switches as indicated and where required by the above Code. Comply with switch manufacturers' printed installation instructions.

### 3.2 FIELD QUALITY CONTROL

- A. Testing: Subsequent to completion of installation of electrical disconnect switches, energize circuits and demonstrate capability and compliance with requirements. Except as otherwise indicated, do not test switches by operating them under load. However, demonstrate switch operation through six opening/closing cycles with circuit unloaded. Open each switch enclosure for inspection of interior, mechanical and electrical connections, fuse installation, and for verification of type and rating of fuses installed. Correct deficiencies then retest to demonstrate compliance. Remove and replace defective units with new units and retest.

END OF SECTION 16170

## SECTION 16190 – SUPPORTING DEVICES

### PART 1 GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
  - 1. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.
- C. Shop drawings indicating details of fabricated products and materials.
- D. Engineered Design consisting of details and engineering analysis for supports for the following items:
  - 1. Fastener supporting systems.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
- B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party certification follow-up services.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Slotted Metal Angle and U-Channel Systems:
    - a. Allied Tube & Conduit
    - b. B-Line Systems, Inc.
    - c. GS Metals Corp.
    - d. Unistrut Diversified Products
  - 2. Conduit Sealing Bushings:
    - a. Bridgeport Fittings, Inc.
    - b. Cooper Industries, Inc.
    - c. O-Z/Gedney
    - d. Producto Electric Corp.
    - e. Raco, Inc.
    - f. Spring City Electrical Mfg. Co.
    - g. Thomas & Betts Corp.

## 2.2 COATINGS

- A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

## 2.3 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- B. Fasteners: Types, materials, and construction features as follows:
  - 1. Expansion Anchors: Carbon steel wedge or sleeve type.
  - 2. Toggle Bolts: All steel springhead type.
- C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
- D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

- E. U-Channel Systems: 16-gage steel channels, with 9/16-inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.

#### 2.4 FABRICATED SUPPORTING DEVICES

- A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.
- C. Pipe Sleeves: Provide pipe sleeves of one of the following:
  - 1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate sleeves from the following gage metal for sleeve diameter noted:
    - a. 3-inch and smaller: 20-gage.
    - b. 4-inch to 6-inch: 16-gage.
    - c. over 6-inch: 14-gage.
  - 2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Coordinate with the building structural system and with other electrical installation.
- C. Raceway Supports: Comply with the NEC and the following requirements:
  - 1. Conform to manufacturer's recommendations for selection and installation of supports.
  - 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs, provide additional strength until there is a minimum of 200 lbs safety allowance in the strength of each support.
  - 3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
  5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
  6. Space supports for raceways in accordance with Table I of this section. Space supports for raceway types not covered by the above in accordance with NEC.
  7. Support exposed and concealed raceway within 1 foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
  8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
- D. Vertical Conductor Supports: Install simultaneously with installation of conductors.
- E. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- F. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.
- G. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for raceways and cable installations. For sleeves through fire rated-wall or floor construction, apply UL- listed firestopping sealant in gaps between sleeves and enclosed conduits and cables in accordance with requirements specified elsewhere.
- H. Conduit Seals: Install seals for conduit penetrations of slabs on grade and exterior walls below grade and where indicated. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.

- I. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
  1. Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
  2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
  3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock- resistant fasteners for attachments to concrete slabs.
  
- J. TESTS: Test pull-out resistance of one of each type, size, and anchorage material for the following fastener types:
  1. Expansion anchors.
  2. Toggle bolts.
  
- K. Provide all jacks, jigs, fixtures, and calibrated indicating scales required for reliable testing. Obtain the structural Engineer's approval before transmitting loads to the structure. Test to 90 percent of rated proof load for fastener. If fastening fails test, revise all similar fastener installations and retest until satisfactory results are achieved.
  
- L. Conduit seals at walk-in cooler& freezer location: Install seals for conduit penetrations into cooler or freezer equipment where conduit enters the respective conditional areas, and at slab locations.

3.2 TABLE I: SPACING FOR RACEWAY SUPPORTS

HORIZONTAL RUNS

<u>Raceway Size (Inches)</u> (1)	<u>Conductors</u>	<u>No. of in Run</u>	<u>IMC Location</u>	<u>RMC &amp; EMT (1)</u>
1/2,3/4	1 or 2	Flat ceiling or wall.	5	5
1/2,3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7	7
1/2,3/4	3 or more	Any location.	7	7
1/2-1	3 or more	Any location.		
1 & larger	1 or 2	Flat ceiling or wall.	6	6
1 & larger	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	10	10
1 & larger	3 or more	Any location.	10	10
Any	....	Concealed.	10	10

VERTICAL RUNS

<u>Raceway Size (Inches)</u>	<u>No. of Conductors in Run</u>	<u>Location</u>	<u>RMC &amp; IMC (1,2)</u>	<u>EMT (1)</u>
1/2,3/4	....	Exposed.	7	7
1,1-1/4	....	Exposed.	8	8
1-1/2				
and larger	....	Exposed.	10	10
Up to 2	....	Shaftway.	14	10
2-1/2	....	Shaftway.	16	10
3 & larger	....	Shaftway.	20	10
Any	....	Concealed.	10	10

NOTES:

(1) Maximum spacing of supports (feet).

(2) Maximum spacings for IMC above apply to straight runs only. Otherwise the maximums for EMT apply.

Abbreviations:        EMT Electrical metallic tubing.  
                              IMC Intermediate metallic conduit.  
                              RMC Rigid metallic conduit.

END OF SECTION 16190



## SECTION 16195 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:
  - 1. Identification labeling for switchboards, panelboards, devices, raceways, cables, and conductors.
  - 2. Operational instruction signs.
  - 3. Warning and caution signs.
  - 4. Equipment labels and signs.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 16 Section "Wires and Cables." for requirements for color coding of conductors for phase identification.
- C. Refer to other Division 16 sections for additional specific electrical identification associated with specific items.

#### 1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Schedule of identification nomenclature to be used for identification signs and labels.
- D. Samples of each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."

- B. ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  1. American Labelmark Co.
  2. Ideal Industries, Inc.
  3. LEM Products, Inc.
  4. Markal Corp.
  5. National Band and Tag Co.
  6. Panduit Corp.
  7. Seton Name Plate Co.

### 2.2 ELECTRICAL IDENTIFICATION PRODUCTS

- A. Adhesive Marking Labels for Raceway and Cable: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service (Emergency, Lighting, Power, Light, Air Conditioning, Communications, Control, Fire, etc.).
- B. Label Size: as follows:
  1. Raceways 1-Inch and Smaller: 1-1/8 inches high by 4 inches long.
  2. Raceways Larger than 1-Inch: 1-1/8 inches high by 8 inches long.
- C. Color: Black legend on orange background.
- D. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.
- E. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Raceway and Cable Identification: Flexible acrylic bands sized to suit the raceway diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the raceway or cable.
- F. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- G. Plasticized Card Stock Tags: Vinyl cloth with preprinted and field-printed legends to suit the application. Orange background, except as otherwise indicated, with Eyelet for fastener.

- H. Engraved, Plastic-Laminated Labels, Signs, and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8-inch thick for larger sizes. Engraved legend in white letters on black face and punched for mechanical fasteners.
- I. Baked-Enamel Warning and Caution Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size appropriate to the location.
- J. Exterior Metal-Backed Butyrate Warning and Caution Signs: Weather-resistant, nonfading, preprinted cellulose acetate butyrate signs with 20-gage, galvanized steel backing, with colors, legend, and size appropriate to the location. Provide 1/4-inch grommets in corners for mounting.
- K. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.
- L. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from minus 50 deg F to 350 deg F. Provide ties in specified colors when used for color coding.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.
- B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- D. Conduit Identification:
  - 1. The following areas shall be identified:
    - a. On wall surfaces directly external to conduits run concealed within wall.
    - b. On all accessible surfaces of concrete envelope around conduits in vertical shafts, exposed at ceilings or concealed above suspended ceilings.

2. Apply identification to areas as follows:
  - a. Clean surface of dust, loose material, and oily films before painting.
  - b. Prime surfaces: For galvanized metal, use single-component acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty acrylic resin block filler. For concrete surfaces, use clear alkali-resistant alkyd binder-type sealer.
  - c. Apply one intermediate and one finish coat of orange silicone alkyd enamel.
  - d. Apply primer and finish materials in accordance with manufacturer's instructions.
  
- E. Identify Raceways of Certain Systems with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Install bands at changes in direction, at penetrations of walls and floors, and at 40-foot maximum intervals in straight runs. Apply the following colors:
  1. Fire Alarm System: Red
  2. Fire Suppression Supervisory and Control System: Red
  3. Mechanical and Electrical Supervisory System: Green and Blue
  4. Telephone System: Green and Yellow
  
- F. Identify Junction, Pull, and Connection Boxes: Code-required caution sign for boxes shall be pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.
  
- G. Conductor Color Coding: Provide color coding for secondary service, feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

<u>208Y/120 Volts</u>	<u>Phase</u>	<u>120/240Volts</u>
Black	A	Black
Red	B	Red
Blue	C	-
White	Neutral	White
Green	Ground	Green

- H. Use conductors with color factory-applied the entire length of the conductors except as follows:

1. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
  - a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.
  - b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.
  
- I. Tag or label conductors as follows:
  1. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
  2. Multiple Circuits: Where multiple branch circuits or control wiring or signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and signal wiring, use color coding or wire marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire marking tapes.
  3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.
  
- J. Apply warning, caution, and instruction signs and stencils as follows:
  1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
  
- K. Install equipment identification as follows:
  1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes alarm systems,

unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/2-inch-high lettering on 1-1/2-inch-high label (2-inch-high where two lines are required), white lettering in black field. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.

- a. Load centers, electrical cabinets, and enclosures.
  - b. Access doors and panels for concealed electrical items.
- L. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.
- M. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

END OF SECTION 16195

## SECTION 16452 – GROUNDING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other sections of these Specifications.
- B. Related Sections: The following sections contain requirements that relate to this Section:
  - 1. Division 16 Section "Wires and Cables."

#### 1.2 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for ground rods, connectors and connection materials, and grounding fittings.
- C. Field-testing organization certificate, signed by the Contractor, certifying that the organization performing field tests complies with the requirements specified in Quality Assurance below.
- D. Report of field tests and observations certified by the testing organization.

#### 1.3 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled. The terms "listed" and "labeled" shall be defined as they are in the National Electrical Code, Article 100.
  - 1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Field-Testing Organization Qualifications: To qualify for acceptance, the independent testing organization must demonstrate, based on evaluation of organization-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the testing indicated.
- C. Electrical Component Standard: Components and installation shall comply with NFPA 70, "National Electrical Code" (NEC).
- D. UL Standard: Comply with UL 467, "Grounding and Bonding Equipment."

### PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Anixter Bros., Inc.
  2. Bashlin Industries, Inc.
  3. Buckingham Mfg. Co.
  4. Erico Products, Inc.
  5. GB Electrical, Inc.
  6. Ideal Industries, Inc.
  7. O-Z/Gedney Co.
  8. Raco, Inc.
  9. Thomas & Betts Corp.

## 2.2 GROUNDING AND BONDING PRODUCTS

- A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.
- B. Conductor Materials: Copper.

## 2.3 WIRE AND CABLE CONDUCTORS

- A. General: Comply with Division 16 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductor: Green insulated.
- C. Grounding Electrode Conductor: Stranded cable.
- D. Bare Copper Conductors: Conform to the following:
1. Assembly of Stranded Conductors: ASTM B-8.

## 2.4 MISCELLANEOUS CONDUCTORS

- A. Ground Bus: Bare annealed copper bars of rectangular cross section.
- B. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bare copper wire, terminated with copper ferrules.
- C. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

## 2.5 CONNECTOR PRODUCTS

- A. General: Listed and labeled as grounding connectors for the materials used.



- B. Pressure Connectors: High-conductivity-plated units.
- C. Bolted Clamps: Heavy-duty units listed for the application.
- D. Exothermic Welded Connections: Provided in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.
- E. Aluminum-To-Copper Connections: Bimetallic type, conforming to UL 96, "Lighting Protection Components," or UL 467.

## 2.6 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
  - 1. Size: 3/4 inch by 10 feet.
  - 2. Size: 5/8 inch by 8 feet.
- B. Plate Electrodes: Copper plates, minimum 0.10 inch thick, size as required per N.E.C. indicated.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
  - 1. Install separate insulated equipment grounding conductors with circuit conductors for the following in addition to those locations where required by Code:
    - a. Lighting circuits.
    - b. Feeders and branch circuits.
    - c. Receptacle Circuits.
    - d. Single-phase motor or appliance circuits.
    - e. Three-phase motor or appliance branch circuits.
  - 2. Busway Circuits: Install separate insulated equipment ground conductor from the ground bus in the switchgear, switchboard, or distribution panel to the equipment ground terminal on the busway.
  - 3. Elevator Equipment Circuits: Install an insulated equipment grounding conductor to electrical devices operating at 120-V and above including hard-wired and plug-cord assemblies. Bond the conductor to each such unit and in accordance with manufacturer's requirements.

### 3.2 INSTALLATION

- A. General: Ground electrical systems and equipment in accordance with NEC requirements except where the Drawings or Specifications exceed NEC requirements.
- B. Braided-Type Bonding Jumpers: Install to connect ground clamps on water meter piping to bypass water meters electrically. Use elsewhere for flexible bonding and grounding connections.
- C. Route grounding conductors along the shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.
- D. Bond interior metal piping systems and metal air ducts to equipment ground conductors of pumps, fans, electric heaters, and air cleaners serving individual systems.

### 3.3 CONNECTIONS

- A. General: Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
  - 2. Make connections with clean bare metal at points of contact.
  - 3. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps.
  - 4. Aluminum to galvanized steel connections shall be with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
- B. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground bus in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors.
- C. Tighten grounding and bonding connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torquing requirements

are not indicated, tighten connections to comply with torque tightening values specified in UL 486A and UL 486B.

- D. Compression-Type Connections: Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
- E. Moisture Protection: Where insulated ground conductors are connected to ground rods or ground buses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

### 3.4 FIELD QUALITY CONTROL

- A. Independent Testing Organization: Arrange and pay for the services of a qualified independent electrical testing organization to perform tests described below.
- B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground resistance level is specified, at service disconnect enclosure ground terminal, and at ground test wells. Measure ground resistance without the soil being moistened by any means other than natural precipitation or natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method in accordance with Section 9.03 of IEEE 81, "Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Grounding System."
- C. Ground/resistance maximum values shall be as follows:
  - 1. Equipment rated 500 kVA and less: 5 Ohms
  - 2. Equipment rated 500 kVA to 1000 kVA: 5 Ohms
  - 3. Equipment rated over 1000 kVA: 3 Ohms
  - 4. Pad Mounted equipment: 5 ohms.
- D. Deficiencies: Where ground resistances exceed specified values, and if directed, modify the grounding system to reduce resistance values. Where measures are directed that exceed those indicated the provisions of the Contract, covering changes will apply.
- E. Report: Prepare test reports, certified by the testing organization, of the ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION 16452

## SECTION 16475 – OVERCURRENT PROTECTIVE DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes overcurrent protective devices (OCPDs) rated 600 V and below and switching devices commonly used with them.
- B. Panelboards: Application, installation, and other related requirements for overcurrent protective device installations in distribution equipment are specified in other Division 16 sections.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Cartridge Fuses:
    - a. Bussmann
    - b. Ferraz Shawmut
    - c. Littelfuse Inc.
  - 2. Fusible Switches:
    - a. Allen Bradley Co.
    - b. Crouse Hinds Distribution Equipment.
    - c. Eaton Corp.
    - d. General Electric Co.
    - e. Siemens Energy & Automation, Inc.
    - f. Schneider Electric (Square D)
  - 3. Molded Case Circuit Breakers:
    - a. Eaton Corp.
    - b. General Electric Co.
    - c. Siemens Energy & Automation, Inc.
    - d. Schneider Electric (Square D)

#### 2.2 OVERCURRENT PROTECTIVE DEVICES (OCPDs), GENERAL

- A. General: Provide OCPDs in indicated types, as integral components of panelboards and also as individually enclosed and mounted single units.
- B. General: Provide OCPDs in indicated types, as integral components of panelboards, switchboards, and motor control centers; and also as individually enclosed and mounted single units.
- C. Enclosures: NEMA 250 "Enclosures for Electrical Equipment (1,000 Volts Maximum)."

### 2.3 CARTRIDGE FUSES

- A. General: NEMA Standard FU1, "Low Voltage Cartridge Fuses." Unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage ratings consistent with the circuits on which used.
- B. Class J Fuses: UL 198C, "High Interrupting Capacity Fuses, Current Limiting Type."
- C. Class L Fuses: UL 198C, "High Interrupting Capacity Fuses, Current Limiting Type."
- D. Class RK1 and RK5 Dual Element Time Delay Fuses: UL 198E, "Class R Fuses."
- E. Class RK1 Fast Acting Fuses: UL 198E, "Class R Fuses."

### 2.4 FUSIBLE SWITCHES

- A. General: UL 98 "Enclosed and Dead Front Switches" and NEMA KS 1 "Enclosed Switches," quick make, quick break heavy duty units.
- B. Rating: Load breaking capacity in excess of the normal horsepower rating for the switch.
- C. Withstand Capability: In excess of the let through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.
- D. Operation: By means of external handle.
- E. Interlock: Prevents access to switch interior except when in "off" position.
- F. Fuse Clips: Rejection type.
- G. Padlocking Provisions: For 2 padlocks, whether open or closed.

- H. Enclosure for Independent Mounting: NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.

## 2.5 MOLDED CASE CIRCUIT BREAKERS

- A. General: UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures," and NEMA AB 1, "Molded Case Circuit Breakers."
- B. Construction: Bolt in type, except breakers 225 ampere frame size and larger may be plug in type if held in place by positive locking device requiring mechanical release for removal.
- C. Construction: Bolt in type, except breakers in load center type panelboards and breakers 225 ampere frame size and larger may be plug in type if held in place by positive locking device requiring mechanical release for removal.
- D. Characteristics: Indicated frame size, trip rating, number of poles, and a short circuit interrupting capacity rating of 10,000 amperes symmetrical, unless a greater rating is indicated.
- E. Tripping Device: Quick make, quick break toggle mechanism with inverse time delay and instantaneous overcurrent trip protection for each pole.
- F. Enclosure for Panelboard Mounting: Suitable for panel mounting in switchboard or panelboards where indicated.
- G. Enclosure for Independent Mounting: NEMA Type 1 enclosure, except as otherwise indicated or required to suit environment where located.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Independently Mounted OCPDs: Locate as indicated and install in accordance with manufacturer's written installation instructions.
- B. OCPDs in distribution equipment shall be factory installed.

### 3.2 IDENTIFICATION

- A. Identify components in accordance with Division 26 Section "Electrical Identification."

### 3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between OCPDs and control/indication devices as specified in Division 16 Section "Wires and Cables" for hard wired connections.

### 3.4 CONNECTIONS

- A. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

### 3.5 GROUNDING

- A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

### 3.6 FIELD QUALITY CONTROL

- A. Independent Testing Organization: Arrange and pay for the services of an independent electrical testing organization to perform tests and observations on OCPDs.
- B. Reports: Prepare written reports certified by testing organization on tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include complete records of repairs and adjustments made.
- C. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating test results, date, and responsible organization and person.
- D. Schedule visual and mechanical inspections and electrical tests with at least one week's advance notification.
- E. Pretesting: Upon completing installation of the system, perform the following preparations for independent tests:
  - 1. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
  - 2. Make continuity tests of circuits.
  - 3. Provide set of Contract Documents to test personnel. Include full updating on final system configuration and parameters where they supplement or differ from those indicated in original Contract Documents.
  - 4. Provide manufacturer's instructions for installation and testing of OCPDs to test personnel.
- F. Visual and mechanical inspection: Include the following inspections and related work.
  - 1. Overcurrent Protective Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall

- recommend final protective device ratings and settings. Use accepted revised ratings or settings to make the final system adjustments.
2. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
  3. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
  4. Check tightness of electrical connections of OCPDs with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
  5. Clean OCPDs using manufacturer's approved methods and materials.
  6. Verify installation of proper fuse types and ratings in fusible OCPDs.
- G. Electrical Tests: Include the following items performed in accordance with manufacturer's instructions:
1. Insulation resistance test of OCPD conducting parts. Insulation resistance less than 100 megohms is not acceptable.
  2. Contact resistance test or measurement of millivolt drop across contacts of drawout circuit breakers and fused power circuit devices at rated current. Compare contact resistance or millivolt drop values of adjacent poles and of similar breakers. Deviations of more than 50 percent are not acceptable.
  3. Insulation resistance test of fused power circuit devices and insulated case and molded case circuit breakers over 600 ampere frame size at 1000 V d.c. for one minute from pole to pole and from each pole to ground with breaker closed and across open contacts of each phase. Insulation resistance less than 100 megohms is not acceptable.
  4. Use primary current injection to check performance characteristics of trip units of molded case breakers over 600 ampere frame size. Trip characteristics not falling within manufacturer's published time current characteristic tolerance bands when adjusted to approved parameters are not acceptable. Perform the following tests:
    - a. Determine minimum pickup current acceptable per manufacturer's instructions.
    - b. Determine long time delay at 300 percent pickup current.
    - c. Determine short time pickup current and corresponding delay time.
    - d. Determine ground fault current pickup and corresponding delay time.
    - e. Determine instantaneous pickup current value.
  5. Make adjustments for final settings of adjustable trip devices.
  6. Activate auxiliary protective devices such as ground fault or undervoltage relays, to verify operation of shunt trip devices.
  7. Check operation of electrically operated OCPDs in accordance with manufacturer's instructions.



- H. Retest: Correct deficiencies identified by tests and observations and provide retesting of OCPDs by testing organization. Verify by the system tests that specified requirements are met.

### 3.7 CLEANING

- A. Upon completion of installation, inspect OCPDs. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

### 3.8 DEMONSTRATION

- A. Training: Arrange and pay for the services of factory authorized service representatives to demonstrate OCPDs and train Owner's maintenance personnel.
- B. Conduct a minimum of one half day of training in operation and maintenance as specified under "Instructions to Owner Employees" in the "Project Closeout" Section of these specifications. Include both classroom training and hands on equipment operation and maintenance procedures.
- C. Schedule training with at least seven days' advance notification.

### 3.9 COMMISSIONING

- A. Infrared Scanning: After Substantial Completion, but not more than 2 months after Final Acceptance, perform an infrared scan of OCPDs including their line and load connections, fuses, and fuse clips. Also scan OCPD contact structures where accessible to a portable scanner. Include individual OCPDs and those installed in switchboards, panelboards, and motor control centers.
- B. Follow up Infrared Scanning: Perform two additional follow up infrared scans of the same devices: one four months after Substantial Completion, and one 11 months after Substantial Completion.
- C. Instrument: Use an infrared scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
- D. Record of Infrared Scanning: Prepare a certified report identifying all OCPDs checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and rescanning observations after remedial action.

END OF SECTION 26 28 00

## SECTION 16515 – EXTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.
- B. Luminaires shall comply with Illumination Engineering Society of North America (IESNA) requirements as well as International Dark-Sky Association requirements.

#### 1.3 DEFINITIONS

- A. Fixture: A complete lighting unit. Fixtures include lamping and parts required to distribute the light, position and protect lamping, and connect lamping to the power supply.
- B. Luminaire: Fixture.
- C. Average Life: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data describing fixtures, lamping, drivers and ballasts. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:
  - 1. Outline drawings of fixtures indicating dimensions and principal features.
  - 2. Electrical ratings and photometric data with specified lamping and certified results of independent laboratory tests.
  - 3. Data on batteries and chargers for exterior fixtures with emergency drivers.
- C. Maintenance data for products for inclusion in Operating and Maintenance Manual specified in Division 1.

- D. Product certifications signed by manufacturers of lighting fixtures certifying that their fixtures comply with specified requirements.
- E. Shop drawings from manufactures detailing nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70 "National Electrical Code" for components and installation.
- B. Listing and Labeling: Provide fixtures and exit sign units that are listed and labeled for their indicated use on the Project.
  - 1. The terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful in service performance.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide manufacturer's standard provisions for protecting fixtures during transportation, storage, and installation. Do not store outside. Store indoors in an area that is within manufacturers storage temperature range. Do not remove factory-applied wrappings until just before installation.

### PART 2 - PRODUCTS

#### 2.1 FIXTURES, GENERAL

- A. Comply with the requirements specified in the Articles below and luminaire schedule.

#### 2.2 LUMINAIRES

- A. Luminaires shall be UL Listed for outdoor wet locations and shall utilize energy efficient LED light sources.
- B. Vandalism: Fixtures shall be vandal resistant and shall utilize a high impact acrylic or UV stabilized polycarbonate lens. Fixture hardware shall be tamper resistant.

- C. Dark Sky Friendly: Fixtures shall be full cutoff with total uplighting levels not exceeding amount allowed to be compliant with dark sky rating.

### 2.3 LAMPS

- A. Fixtures shall utilize LED lamp module arrays.
- B. Color temperature shall be as indicated on the luminaire schedule.

### 2.4 BALLASTS AND DRIVERS

- A. LED drivers shall be cold weather, field replaceable and integrated with fixture housing.
- B. Ballasts and drivers shall include a five (5) year manufacturer's warranty.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Setting and Securing: Set units plumb, square, and level and secure according to manufacturer's printed instructions and approved shop drawings.

### 3.2 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of fixtures with emergency drivers. Include the following in tests of fixtures with emergency drivers.
  - 1. Duration of supply with central battery system.
  - 2. Normal transfer to battery source and retransfer to normal.
- E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.3 ADJUSTING AND CLEANING

- A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.
  
- B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16512

## SECTION 16515 – INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions apply to this Section.
- B. Requirements specified in other Division 16 Sections apply to this section.

#### 1.2 SUMMARY

- A. This Section includes interior luminaires.
- B. This Section also includes interior luminaires equipped with emergency driver, egress/exit lighting units and accessories.

#### 1.3 DEFINITIONS

- A. Fixture: A complete lighting unit. Fixtures include lamping and parts required to distribute the light, position and protect lamping, and connect lamping to the power supply. Internal battery powered emergency lighting units and exit signs also include a battery and the means for controlling and recharging the battery.
- B. Luminaire: Fixture.
- C. Average Life: The time after which 50 percent will have failed and 50 percent will have survived under normal conditions.

#### 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data describing fixtures, lamping, drivers and ballasts. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and the following information:
  - 1. Outline drawings of fixtures indicating dimensions and principal features.
  - 2. Electrical ratings and photometric data with specified lamping and certified results of independent laboratory tests.
  - 3. Data on batteries and chargers for emergency drivers and exit sign lighting units.
- C. Maintenance data for products for inclusion in Operating and Maintenance Manual specified in Division 1.

- D. Product certifications signed by manufacturers of lighting fixtures certifying that their fixtures comply with specified requirements.
- E. Shop drawings from manufactures detailing nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.
- F. Coordination drawings for fixtures mounted on, in, or above the ceiling indicating coordination with ceiling grids and other equipment installed in the same space.
- G. Samples for verification purposes of specific individual fixtures.
- H. Samples for use in full size mockup of specific individual fixtures.

#### 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70 "National Electrical Code" for components and installation.
- B. Listing and Labeling: Provide fixtures and exit sign units that are listed and labeled for their indicated use on the Project.
  - 1. The terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualification: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. Manufacturers Qualifications: Firms experienced in manufacturing fixtures that are similar to those indicated for this Project and that have a record of successful in service performance.
- D. Coordination of Fixtures With Ceiling: Coordinate fixtures mounting hardware and trim with the ceiling system.

#### 1.6 EXTRA MATERIALS

- A. 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 the Owner.
  - 1. Lamps: 10 lamps for each 100 of each type and rating installed. Furnish at least 1 of each type.
  - 2. Plastic Diffusers and Lenses: 1 for each 100 of each type and rating installed. Furnish at least 1 of each type.

## PART 2 - PRODUCTS

### 2.1 FIXTURES, GENERAL

- A. Comply with the requirements specified in the Articles below and lighting fixture schedule.

### 2.2 FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs and sharp corners and edges.
- B. Sheet Metal Components: Steel, except as indicated. Components are formed and supported to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in the operating position.
- D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass except as indicated.
  - 1. Plastic: Highly resistance to yellowing and other changes due to aging, exposure to heat and UV radiation.
  - 2. Lens Thickness: 0.125 inches, minimum.

### 2.3 LED LUMINAIRES

- A. General: Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on luminaire schedules.
- B. Material and specifications for each luminaire are as follows:
  - 1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source, housing, LED array, and electronic driver. LED luminaires designated for emergency lighting shall also contain and emergency driver.
  - 2. Each luminaire shall be rated for a minimum operational life of 50,000 hours.
  - 3. The LED module arrays shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.



4. Luminaire shall be constructed such that LED module arrays can be replaced or repaired without replacement of the entire luminaire.
5. Each luminaire shall be UL 1598 and UL 8750 listed.
6. Refer to luminaire schedules for lumen output, CRI, color temperature and emergency driver requirements of each luminaire type.

#### 2.4 EXIT SIGNS

- A. Conform to UL 924, "Emergency Lighting and Power Equipment," and the following:
  1. Sign Colors: Conform to local code.
  2. Minimum Height of Letters: Conform to local code.
  3. Arrows: Include as indicated.
  4. Lamps: Light Emitting Diodes (LED), 10 year rated lamp life.
  5. Battery: Sealed, maintenance-free.
  6. Charger: Fully automatic, solid-state type with sealed transfer relay.
  7. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  8. Test Switch: Push to test button type integral to unit.
  9. LED Indicator Light: To indicate normal power on. Normal glow shall indicate trickle charge and a bright glow shall indicate charging at end of discharge cycle.

#### 2.5 EMERGENCY LIGHTING UNITS, DECORATIVE

- A. General: The following features apply to decorative emergency light sets:
  1. Self contained emergency lighting units with style, shape, and trim as directed by owner.
  2. Battery: Sealed, maintenance free, lead acid type with 10 year nominal life.
  3. Charger: Minimum two rate, fully automatic, solid state type, with sealed transfer relay.
  4. Operation: Relay turns lamp on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamp operates for duration of outage, up to 1.5 hours. Lamp automatically disconnected from battery of voltage approaches deep discharge level. When normal voltage is restored, battery is automatically recharged within 16 hours and then floated on trickle charge.
  5. Control panel contains low voltage disconnect switch, LED indicator light, test switch, and concealed terminals for remote lamp head connection.
- B. Cylinder Style: Lamp, battery, charger, and relay mounted in cylindrical housing. Unit shall have the following features:
  1. Cylinder shall be mounted on metal base with locking swivel joint providing 180 deg, 2 way lamp aiming.

2. Shallow profile base shall form connection box and house control panel. Mounts on wall or ceiling.
- C. Recessed Lay in Ceiling Type with Lamp Heads and the following features:
1. Fixtures shall be suitable for recessed lay in installation in 2 by 2 and 2 by 4 exposed grid ceilings without additional supports. Maximum recessing depth shall be 5 1/2 inches.
  2. Lamp head mounting panel shall be flush with finished ceiling, 18 gage steel, minimum; mounts for control panel.
  3. Two lamp heads shall be mounted on base, with 180 deg, 2 way, locking swivel joints for aiming. Frosted acrylic lenses and lamp types shall be as directed by Owner.
  4. Finish: Matte white for exposed parts, or as directed by Owner.
- D. Surface Mounted Type with Lamp Heads: Surface wall mounted, with two lamp heads, and the following features:
1. Integral lamp heads mounted on housing with 180 deg, 2 way locking swivel joints for aiming. Lamp types and lenses as directed by Owner.
  2. Finish: Exposed parts shall be matte white, or as directed by Owner.
- E. Recessed or Semi-recessed Type with Lens: Wall or ceiling mounted with the following features:
1. Lamps and reflectors as directed by Owner.
  2. Finish: Matte white for exposed parts, or as directed by Owner.
  3. Trim at wall or ceiling conceals fixture opening.
  4. Lens: 0.125 inch thick prismatic acrylic.
- F. Surface Mounted Type with Lens: Wall or ceiling mounted unit with the following features:
1. Lamps and reflectors as directed by Owner.
  2. Finish: Matte white for exposed parts or as directed by Owner.
  3. Lens: 0.125 inch thick prismatic acrylic.

## 2.6 EMERGENCY LIGHTING UNIT, GENERAL PURPOSE

- A. Self contained, surface wall mounted, with two lamp heads and provisions for a third lamp head, and having the following features:
1. Housing: 20 gage steel or high impact thermoplastic, conforming to UL 94 V O.
  2. LED indicator light and test switch shall be on front panel, with concealed terminals for remote lamp heads.
  3. Integral lamp heads shall be mounted on housing with 180 deg, 2 way, locking swivel joints for aiming.
  4. Battery: Sealed, maintenance free, lead acid type, with 10 year normal life.

5. Charger: Minimum 2 rate, fully automatic, solid state type, with sealed transfer relay and fused output circuits.
6. Finish: Manufacturer's standard for exposed parts, baked enamel on steel.
7. Operation: Relay turns lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. Lamps automatically disconnect from battery when voltage approaches deep discharge value. When normal voltage is restored, battery is automatically recharged.

## 2.7 EMERGENCY POWER SUPPLY

- A. Internal Type: For designated fixture typess, provided under Division 26 Section "Lighting," provide internal self contained, modular, battery inverter unit, factory mounted within the fixture body.
  1. Arrange unit with test switch and LED indicator light, visible and accessible without opening fixture or entering ceiling space.
  2. Battery: Sealed, maintenance free, nickel cadmium type, with normal 10 year life, minimum.
  3. Charger: Fully automatic, solid state, constant current type.
  4. Operation: Relay turns two lamps on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. When normal voltage is restored, battery is automatically recharged.
  
- B. External Type: For designated fixture types, provided under Division 26 Section "Lighting," provide external self contained, modular, battery inverter unit.
  1. Arrange unit with test switch and LED indicator light, visible and accessible without entering ceiling space.
  2. Battery: Sealed, maintenance free, nickel cadmium type, with normal 10 year life, minimum.
  3. Charger: Fully automatic, solid state, constant current type.
  4. Operation: Relay turns two lamps of associate fixture on automatically when supply circuit voltage drops to 80 percent of nominal or below. Lamps operate for duration of outage, up to 1.5 hours. When normal voltage is restored, battery is automatically recharged.

## 2.8 FINISH

- A. Steel Parts: Manufacturer's standard finish applied over corrosion resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.
  
- B. Other Parts: Manufacturer's standard finish.

## 2.9 SUSPENDED FIXTURE SUPPORT COMPONENTS

- A. Suspended fixtures as indicated in manufacturers installation instructions. See fixture schedule and installation requirements listed below for further requirements.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved shop drawings.
- B. Support For Recessed and Semi-recessed Fixtures: Installed units are not to be supported from suspended ceiling support system. Install ceiling system support rods or wires at a minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.
  1. Fixtures Smaller Than Ceiling Grid: Install a minimum of four rods or wires for each fixture and locate at corner of the ceiling grid where the fixture is located. Do not support fixtures by ceiling acoustical panels.
  2. Fixtures of Sizes Less Than Ceiling Grid: Center in the acoustical panel. Support fixtures independently with at least two 3/4 inch metal channels spanning and secured to the ceiling tees.
  3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.
- C. Support for Suspended Fixtures: Brace pendants and rods that are 4 feet long or longer to limit swinging. Support stem mounted single unit suspended fluorescent fixtures with twin stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.
- D. Lamping: Lamp units according to manufacturer's instructions.

### 3.2 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Give advance notice of dates and times for field tests.
- C. Provide instruments to make and record test results.
- D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency

lighting installation. Include the following in tests of emergency lighting equipment.

1. Duration of supply with central battery system.
2. Normal transfer to battery source and retransfer to normal.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

### 3.3 ADJUSTING AND CLEANING

A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 16515