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ARCHITECT OF RECORD

James Edward Turner
Cyntergy, LLC
810 S. Cincinnati Ave
2nd Floor
Tulsa, Oklahoma 74119

LICENSED ARCHITECT
JAMES EDWARD TURNER
019425
STATE OF ILLINOIS
EXPIRES 11-30-2018
7/24/17
Architect of Record

MECHANICAL ENGINEER OF RECORD

Jeffery Don Ferguson
Cyntergy, LLC
810 S. Cincinnati Ave
2nd Floor
Tulsa, Oklahoma 74119

LICENSED PROFESSIONAL ENGINEER
JEFFERY D. FERGUSON
062-059784
STATE OF ILLINOIS
Expires 11-30-2017
07/24/17
Mechanical Engineer of Record

Scott AFB
Project Specifications Seals Page
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07/24/17
100% Design Submittal
SEALS PAGE (Continued)

ELECTRICAL ENGINEER OF RECORD

Eric S. Kesterson
Cyntergy, LLC
810 S. Cincinnati Ave
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Tulsa, Oklahoma 74119

Expires: 11-30-2017

Electrical Engineer of Record

FIRE PROTECTION ENGINEER OF RECORD

James Roy Spradling
Cyntergy, LLC
810 S. Cincinnati Ave
2nd Floor
Tulsa, Oklahoma 74119

Expires: 11-30-2017

Fire Protection Engineer of Record
PART 1 - GENERAL

1.1 CONTRACTING OFFICERS APPROVAL
   A. The contract is based on materials and methods described in the contract document.
   B. The Contracting Officer will consider proposals for substitution of materials, equipment and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Contracting Officer to evaluate the proposed substitution.
   C. Do not substitute materials or equipment, unless such substitution has been specifically approved for this Work by the Contracting Officer.
   D. All substitution requests submitted during solicitation (bid phase) must be received by the Contracting Officer no later than 10 days prior to solicitation due date.

1.2 “OR EQUAL”
   A. Where the phrase “or equal” or “or equal as approved in advance by the Contracting Officer” occurs in the Contract Documents, do not assume that material and equipment will be approved as equal by the Contracting Officer unless the item has been specifically approved for this work by the Contracting Officer.
   B. The decision of the Contracting Officer shall be final.

1.3 AVAILABILITY OF SPECIFIED ITEMS
   A. Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work.
   B. In the event specified item or items will not be so available, notify the Contracting Officer prior to receipt of bids.
   C. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by EXCHANGE.

1.4 SUBSTITUTIONS FOLLOWING AWARD OF CONTRACT
   A. Substitutions for Cause: Not later than 15 days prior to time required for preparation and review of submittals.
   B. Substitutions for Convenience: Not allowed.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 00 04 04
PART 1   GENERAL

1.1 STATEMENT OF WORK

A. The work covered by these specifications consists of furnishing all plant, supervision, labor, equipment, materials and incidentals necessary to perform all operations required to complete the work, all in accordance with these specifications and the applicable drawings, and subject to the terms and conditions of the contract.

The work to be performed is located at Scott Air Force Base, Building 1981

B. Principal Features:

1. The work to be performed in connection with this project includes, but is not limited replacing wall and floor finishes and remodeling restrooms and customer areas in the Ft. Benning Shopping Center. Work includes mechanical, plumbing, fire protection and electrical work related to the image upgrade.

2. Improvements will include the following:
   a. New Signage and floor finishes at the Service Mall. Remodeling of existing tenant spaces and restrooms within the mall.
   b. Remodel of work and dining areas at the Food Court including new floor finishes.
   c. Remodel of the Administrative Offices and MPA including new floor and wall finishes.
   d. Removal of the Main Store Sales including new floor and wall finishes.

1.2 SPECIAL BASE REQUIREMENTS

A. Regular business hours during the week for the Department of Public Works are 7:00AM to 4:00PM, Monday through Friday, excluding Federal Holidays. The Exchange normal business hours of operation are from 9:00AM to 7:00PM, Monday through Saturday and 10:00AM to 8:00PM on Sundays. On Holidays the Exchange is open from 10:00AM to 6:00PM. Due to the unique nature and aggressive schedule of this project, the Contractor may be required to work 24 hours a day/ 7 days a week. Also, many items of work can only be performed at night after hours once the Exchange is closed to customers. The Exchange will be available to the Contractor on a 24/7 basis. A 24 hour advance notice to the Exchange General Manager is required to confirm on site security is available during non-operation hours. Failure on the part of the Contractor to give this advance notice may result in the facility not being accessible for work. The Contractor shall coordinate this work schedule closely with the EXCHANGE store manager and notify the Installation Military Police prior to performing work after normal business hours.

B. The Contractor is to familiarize themselves with the requirements for gaining daily access to the base. All workers, subcontractors and material deliveries will require permits to gain site entry.

C. Scott AFB may require special access requirements during times of heightened security measures and/or force protection events requiring the Contractor to adjust schedules and access accordingly. Advance notice will be given to the Contractor as soon as possible in the event of such an occurrence.

1.3 UTILITIES (WATER, GAS AND ELECTRICITY)
A. Existing hose bibbs will be used to obtain water for this project. The Contractor will not be charged for consumption of utilities (water, gas and electricity) refer to Section 01 50 00, “Temporary Facilities and Controls”.

1.4 LAYING OUT WORK

A. Dimensions and elevations indicated in layout of work shall be verified by the Contractor. Discrepancies between drawings, specifications, and conditions shall be referred to the Contracting Officer in writing for adjustment before work affected is performed. Failure to make such notifications shall place responsibility upon the Contractor to carry out work in a satisfactory and workmanlike manner.

B. The Contractor shall be held responsible for the location and elevation of all the construction contemplated by the construction documents.

C. Prior to commencing work, the Contractor shall carefully compare and check all Architectural, Structural, Mechanical, and Electrical drawings, each with the other, that in any way affect the locations of elevation of the work to be executed by him, and should any discrepancy be found, he shall immediately report the same to the Contracting Officer for verifications and adjustment. Any duplication of work made necessary by failure or neglect on the Contractor's part to comply with this function shall be done at his sole expense.

D. The drawings accompanying these specifications indicate generally the design and arrangement of all apparatus, fixtures, accessories, etc. necessary to complete the work required. The exact location or arrangement of equipment is subject to minor changes necessitated by field conditions and shall be made as required without additional cost to EXCHANGE. Measurements shall be verified by actual observations at the construction site, and the Contractor shall be responsible for all work fitting into place in a satisfactory and workmanlike manner meeting the approval of the Contracting Officer.

1.5 EXISTING OVERHEAD OR UNDERGROUND WORK

A. Carefully check the site where this project is to be erected and observe any overhead wires and equipment. Any such work shall be moved, replaced, or protected, as required, whether or not shown or specified.

B. Attention is directed to the existence of pipe and other underground improvements which are shown on the drawings. All reasonable precautions shall be taken to preserve and protect all such improvements shown on the drawings.

C. Locations of underground lines, shown on the drawings, are based on the best available sources, but are to be regarded as approximate only. Exercise extreme care in locating and identifying these lines before excavating in adjacent areas.
1.6 INTERRUPTION OF EXISTING UTILITIES SERVICES

A. The Contractor shall perform the work under this Contract with a minimum of outage time for all utilities. Interruption shall be by approved section of the utility. In some cases, the Contractor may be required to perform the work while the existing utility is in service. The existing utility services may be interrupted only when approved by the Contracting Officer. When it is necessary to interrupt the existing utilities, the Contractor shall notify the Contracting Officer and facilities engineer in writing at least seven days in advance of the time he desires the existing service to be interrupted. The interruption time shall be kept to a minimum. Depending upon the activities at the facility which require continuous service from the existing utility, an interruption may not be subject to schedule at the time desired by the Contractor. In such cases the interruption may have to be scheduled at a time of minimum requirement of demand for the utility. The amount of time requested by the Contractor for interruption of existing utility services shall be as approved by the Contracting Officer.

1.7 EXCAVATION

A. Prior to commencing any excavation work the Contractor shall obtain a valid Excavation Permit, from the Facilities Engineers Office. It shall be the Contractor's responsibility to obtain the necessary signatures and coordination for the permit.

1.8 WELDING PERMIT

A. Prior to commencing any welding, the Contractor shall obtain a welding permit from the Facilities Engineer's or Fire Department.

1.9 BARRICADES AND WARNING DEVICES

A. The Contractor shall provide barricades and lighting devices, in accordance with Manual for Uniform Traffic Control Devices by the State Department of Transportation, latest Edition, at all points of excavation and construction in vehicle traffic areas.

1.10 PROTECTION FOR OPEN FLAME DEVICES

A. When open flame and/or spark producing devices, i.e., acetylene oxygen welding equipment, electric arc welding, etc., are employed for job accomplishment, the following procedures are mandatory:

1. Inspect all surroundings and equipment to insure that combustible substances are not present in any area where contact of metal at a temperature above the flashpoint of any compound is possible.
2. Ensure that no open containers or spills of combustible substances are present.
3. Ensure that ignition is not possible by conduction, convection, radiation, or dispersion of molten metal.
4. Proper protection equipment and practices will be used, i.e., fireproof blankets, wetting of surrounding area, removal of combustible materials where practicable, earth filled backing and portable fire extinguishers of proper type on hand.
5. When the above devices are being used notify the Installation Fire Department 24 hours ahead of usage.
1.11 FIRE PROTECTION

A. The Contractor shall at all times maintain good housekeeping practices to reduce the risk of fire damage. All scrap materials, rubbish, and trash shall be removed daily from in and about the building and shall not be permitted to be scattered on adjacent property.

B. Suitable storage space shall be provided 50 feet minimum outside the building area for storing flammable materials and paints; no storage will be permitted in the building. Excess flammable liquids being used inside the building shall be kept in closed metal containers and removed from the building during unused periods.

C. A contractor shall provide a fire extinguisher at each location where cutting and welding is being performed. Where electric or gas welding or cutting is done, interposed shields of incombustible material shall be used to protect against fire damage due to sparks and hot metal. When temporary heating devices are used, a watchman shall be present to cover periods when other workmen are not on the premises.

D. The Contractor shall provide fire extinguishers in accordance with the recommendations of NFPA No. 10 and 241. However, in all cases a minimum of four fire extinguishers shall be available for each building.

E. Fire Codes: The Contractor shall obey all requirements of the National Fire Codes, and Base/Post Fire Regulations, as they relate to his work on base/post.

1.12 WORK BY OTHERS (IF APPLICABLE)

A. Work not included: Except for such auxiliary work as is shown or specified or is necessary as a part of the construction, the following work is not included in the Contract:

1. Any work shown, but marked "NOT IN CONTRACT" (N.I.C.).
2. Any work indicated to be furnished and installed by the Exchange.
3. Any work indicated to be furnished and installed by the Vendors or Concessionaires.

1.13 EXCHANGE-FURNISHED AND INSTALLED EQUIPMENT (IF APPLICABLE)

A. See Specification Section 01 10 17: EXCHANGE Furnished and Installed Equipment.

1.14 EXCHANGE FURNISHED-CONTRACTOR INSTALLED EQUIPMENT (IF APPLICABLE)

A. See Specification Section 01 10 18: EXCHANGE Furnished Contractor Installed Equipment.

1.15 LINING OF JOINTS IN FINISH MATERIALS

A. It shall be the responsibility of the Contractor to make certain in the installation of jointed floor, wall, and ceiling and pavement materials that:

1. The joints line through in a straight line and in both directions wherever possible.
2. The joints relate to all openings and breaks in the structure and be symmetrically placed wherever possible. This includes heating registers, light fixtures, equipment, etc.
3. If, because of the non-related sizes of the various materials and locations of openings, etc., it is not possible to accomplish the above, the Contractor shall meet with the Contracting Officer to determine the most satisfactory arrangement. The Contractor shall establish center lines for all trades.

1.16 INTEGRATING WORK

A. All streets, buildings, and other improvements shall be protected from damage.

B. Contractor's operations shall be confined to the immediate vicinity of the project work and shall not in any way interfere with or obstruct the ingress or egress to and from street or adjacent property.

C. If new work is to be connected to existing work, special care shall be exercised not to disturb or damage the existing work more than necessary. All damaged work shall be replaced, repaired, and restored to its original condition at no cost to the Exchange Service.

1.17 HEADROOM UNDER PIPES

A. All horizontal runs of plumbing and heating pipes and/or electrical conduit suspended from ceilings shall provide for a maximum headroom clearance, but in no case shall this clearance be less than 7'-0" without written consent from the Contracting Officer. Where piping or conduit is left exposed within a room, the same shall run true to plumb, horizontal or intended planes. Where possible, uniform margins are to be maintained between parallel lines and/or adjacent wall, floor, or ceiling surfaces.

1.18 PATCHING GOVERNMENT-OWNED FACILITIES

A. Government-owned structures, facilities, streets, curbs, walks, etc., that are damaged or removed due to required excavations or other construction work, shall be patched, repaired or replaced, and be left in their original state of repair by the Contractor, to the satisfaction of the Contracting Officer and of authorities having jurisdiction thereof.

1.19 LOCATION OF EQUIPMENT AND PIPING

A. Drawings showing location of equipment, piping, ductwork, etc., are diagrammatic and job conditions shall not always permit their installation in the location shown. When this situation occurs, it shall be brought to the Contracting Officer's attention immediately and the relocation determined in a joint conference. The Contractor will be held responsible for the relocating of any items without first obtaining the Contracting Officer's approval. He shall remove and relocate such items at his own expense if so directed by the Contracting Officer.

1.20 OVERLOADING

A. The Contractor shall be responsible for overloading any part or parts of structures beyond their safe calculated carrying capacities by placing of materials, equipment, tools, machinery, or any other item thereon. No loads shall be placed on floors or roofs before they have attained their permanent and safe strength.
1.21 STANDARDS

A. Any material specified by reference to the number, symbol, or title of a specific standard such as Commercial Standard, a Federal Specification, a trade association standard, or other similar standard shall comply with the requirements in the latest revision thereof, and any amendment or supplement thereto, in effect on the date of invitation for proposals, except as limited to type, class, or grade, or modified in such reference, and except as otherwise indicated.

B. The standard referred to, except as modified in the specifications, shall have full force and effect as though printed in these specifications. These standards are not furnished to bidders for the reason that the manufacturers and trades involved are assumed to be familiar with their requirements.

1. Where Federal Specifications are referred to as a measure of quality and standard, they refer to Federal Specifications established by the Procurement Division of the United States Government and are available from the Superintendent of Documents, U.S. Government Printing Office.

2. Where Federal Specification numbers are used, they refer to the latest edition including amendments thereto.

3. Where Commercial Standards are referred to as a measure of quality, standard, and method of fabrication, they refer to Commercial Standards issued by the U.S. Department of Commerce.

4. Where ASTM Serial Numbers are used, they refer to the latest tentative specifications, standards specifications, standards methods, or standard method of testing issued by the American Society for Testing and Materials.

1.22 CERTIFICATE OF CONFORMANCE

A. Except where tests and/or inspections in connection with structural materials are specified or required by applicable laws, rules, and regulations, manufacturer's certificate covering conformance with the requirements of the above mentioned Federal Specifications and Commercial Standards may be acceptable in lieu of such items. Such certificates shall be furnished to the Contracting Officer for all items so specified.

1.23 OCCUPANCY BY THE EXCHANGE

A. EXCHANGE shall reserve the right and privilege of partial occupancy during and prior to the absolute completion of the total work. Access shall be allowed at all times to the Exchange and its own Contractors in the endeavor.

1.24 REFERENCES

A. All references to the word "Government" or “Exchange” in the specifications shall mean Army and Air Force Exchange Service (AAFES).

B. Wherever the word "provide" is used in the Contract Documents as a directive, it shall be interpreted as meaning "provide and install completely and ready for use".
C. Definitions:

1. Vendor: Person or persons selling any material item.
2. Base, Post, Installation or Facility: Location on which Exchange is being remodeled.
3. Concessionaire: Person who is directly responsible for the lease of and operation of the concessions such as Beauty Shop, Barber Shop, and Laundry/Dry Cleaners.
4. Architect-Engineer: That person or firm responsible for preparing the working drawings and specifications.
5. AAFES or Exchange: Army and Air Force Exchange Service.
6. Inspection Agency: Project Inspector contracted by EXCHANGE.

1.25 TOXIC MATERIALS

A. Removal or disposal of toxic materials or asbestos is not included in this contract. If the Contractor encounters such materials, he shall immediately notify the Contracting Officer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION
PART 1   GENERAL

1.1 EXCHANGE FURNISHED AND INSTALLED PROPERTY (EF/EI)

A. Property: Property is indicated on the drawings.

B. Schedule: Contractor shall schedule early completion of designated areas for beneficial occupancy by EXCHANGE usage prior to completion of entire project.

C. EXCHANGE will furnish and install equipment as indicated on the Fixture Plan in the drawings.

D. Contractor's Duties:

1. Provide access for EXCHANGE personnel.
2. Coordinate work and cooperate with the installers of the property so that installation can be accomplished in accordance with construction schedule.
3. Provide mechanical and electrical connections to equipment and building systems where indicated on the drawings and in the specification.
4. Provide security of designated areas.
5. Schedule equipment delivery dates and installation times to coordinate with the overall schedule. Provide EXCHANGE advance notice so equipment can be ordered on time.

E. EXCHANGE Duties:

1. Inspect designated area prior to use and issue statement of acceptance of area for installation of property.
2. Make final mechanical and electrical connections between property and building systems where indicated on the drawings and/or in the specifications.
3. Provide custodial services for designated areas during use after beneficial occupancy.

1.2 EXCHANGE ACTIVITIES AFFECTING PROGRESS OF WORK:

A. Retail Sales Areas: Schedule date of installation of fixtures and possession of these areas.

B. MPA: Schedule date of installation of storage shelving and equipment.
C. Serving Areas & Food Preparation Areas: Schedule date of use and possession of food preparation serving areas.

D. Construction in each area at date scheduled for its use and possession by EXCHANGE shall be sufficiently complete, in accordance with Contract Documents, so EXCHANGE may occupy the area for the use for which it is intended. Comply with Contract Clauses titled inspection of Construction, and Use and Possession Prior to Completion.

1.3 ACCEPTANCE OF AREAS FOR BENEFICIAL OCCUPANCY

A. Inspection: Prior to acceptance by EXCHANGE of an area for beneficial occupancy, the Contracting Officer will conduct an inspection of the specific area. A list of deficiencies will be provided to the Contractor.

B. Acceptance: If the Contracting Officer determines the specific area is sufficiently complete for beneficial occupancy by EXCHANGE, the area will be accepted in writing with the exception of the deficiencies listed. The deficiencies listed shall be completed or corrected prior to final acceptance at the completion of the project.

C. Damage: Damage resulting from EXCHANGE's use will not be considered the Contractor's responsibility.

D. Refer to clause entitled "Final Inspection and Acceptance" of the EXCHANGE "General Provisions".

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 FINAL CONNECTIONS:

A. All final electrical connections to EXCHANGE furnished and installed equipment shall be made by the Contractor as part of the construction contract. The GC shall construct all openings, furnish and install required sleeves and conduit, and furnish and install all reinforcing, miscellaneous supports, angles, plates, anchors, and bolts necessary to secure EXCHANGE-furnished equipment in place.

B. The Contractor shall provide for and cooperate with personnel installing EXCHANGE furnished materials and equipment, should overlap of work occur.

END OF SECTION 011017
SECTION 01 10 18
EXCHANGE FURNISHED CONTRACTOR INSTALLED EQUIPMENT

PART 1 GENERAL

1.1 EXCHANGE FURNISHED/CONTRACTOR INSTALLED EQUIPMENT (EF/CI):
   
   A. EXCHANGE furnished/Contractor installed items shall be handled in accordance with the "Army and Air Force Exchange Service General Provisions" clause entitled "EXCHANGE Furnished Property".
   
   B. EXCHANGE Furnished Equipment: EXCHANGE will furnish the equipment indicated for installation by the Contractor, as indicated on Drawings:
   
   C. Contractor's Duties:
      1. Designate required delivery date for each product. Notify the Contracting Officer in advance of the date that EXCHANGE furnished items will be needed.
      2. Repair or replace items damaged as a result of Contractor's operations.
      3. Apply finish indicated, if any.
      4. The installation shall be complete in all respects.
   
   D. EXCHANGE Duties:
      1. Deliver all EXCHANGE furnished items to the job site. Schedule delivery date with supplier in accordance with Progress Chart.
      2. Provide Contractor with installation drawings and instructions.

1.2 DELIVERY:
   
   A. Contractor shall unload, handle, store, protect, uncrate, assemble, set in final position, align, join, and level all Exchange-Furnished material, and shall make all utility connections thereto. EXCHANGE will provide supervision for installation of the material.
   
   B. The material will be received at the job site by a representative of the local EXCHANGE who, together with the Contractor, will jointly verify conditions and quantities. The representative of the local EXCHANGE will then affect receipted transfer of custody of the material to the Contractor. Material damaged by or during construction operations shall be replaced at no additional cost to EXCHANGE.

1.3 FAILURE TO VERIFY:
   
   A. Failure to execute above required verification shall not relieve the Contractor of responsibility for proper installation of the material, which shall be installed without additional cost to EXCHANGE.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION
A. The GC shall construct all openings, furnish and install required sleeves and conduit, and furnish and install all reinforcing, miscellaneous supports, angles, plates, anchors, and bolts necessary to secure EXCHANGE-furnished equipment in place. All final electrical connections to EXCHANGE furnished equipment shall be made by the Contractor as part of the Construction Contract.

END OF SECTION 01 10 18
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor required health and safety plan.
   1. Contractor is responsible for reading the Risk Assessment Plan and following the directions therein.
   2. Contractor must maintain OSHA permissible exposure limits related by the risk assessment: That is, 25 ppm (170 mg/cubic meter) during any 8 hour work shift for a 40-hour week.

B. Sample Construction Hazard Plan.

C. Sample Safety Plan.

1.2 RELATED SECTIONS

A. Submittals - Section 01 33 00 (Construction Hazard Plan, Job Safety and Health Plan, Emergency Response Plan).

B. Record Documents - Section 01 78 39.

C. Environmental Protection – Section 01 35 43

1.3 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

   1. OSHA 1910 R.E.G. - 29CFR, OSHA 1910.120

1.4 SUBMITTALS

A. Submittals for EXCHANGE approval - The following items shall be submitted for EXCHANGE approval:

   1. Designation of Safety Representative: The Contractor shall designate in writing a qualified employee OSHA Trained under 1910.120 responsible for the overall supervision of all accident prevention activities. Duties shall include ensuring applicable safety requirements are incorporated into work methods and inspecting the job site to ensure that safety measures and instructions are actually being applied. This person shall be on site at all times that work is in progress.
   2. The Contractor shall be trained/certified in OSHA 1910.120 procedures. All other employees performing site work will meet OSHA 1910 training requirements for their job capacity.

B. Submittals for Information Only - The following items shall be Contractor certified:

   1. Job Hazard Analysis: Contractor shall develop a job hazard analysis for presentation at the pre-construction conference. The Contractor's job hazard analysis shall list potential hazards that could arise during the course of the work.
2. Job Safety and Health Plan.

   a. The Contractor shall develop a Job Safety and Health Plan for presentation at the Pre-construction conference. The Contractor's Safety Plan shall make whatever provisions are necessary to conduct his work in accordance with current OSHA standards.

   b. The safety and health plan must specifically address the excavation portion of construction and will be specific to perchloroethylene (tetrachloroethylene) (PCE), and incorporate decontamination procedures for personnel and equipment, continuous vapor monitoring, a prohibition against eating in proximity to the site, and a prohibition against the smoking of tobacco products in the proximity to the site.

   c. The following are minimum requirements for the health and safety plan:

      1. The Contractor is responsible for all compounds and degradation products addressed by the Risk Assessment Plan.

      2. Specialized Designs: Specialized designs will be provided when the situation requires. Examples of such designs include, but are not limited to, vapor barriers in areas of known vapor hazard.

      3. Safety Plans: Safety Plans will be the responsibility of the Contractor for construction areas identified by the installation and/or EXCHANGE as areas of known hazards only. These plans are required by 29 CFR 1910 and are the responsibility of the Contractor. This requirement will be coordinated through the Health and Safety Program of the military installation by the Contractor.

      4. Minimum Requirements for the Health and Safety Plan are as follows:

         (a) Must be kept on site, and must be written.

         (b) Will contain a hazard analysis (safety and health risk) for each site task and operation (to be supplied by the installation).

         (c) Will include employee training (per paragraph (3) of 1910.120).

         (d) Will include personal protective equipment to be used by employees for each of the site tasks and operations (paragraph (g) (5) of 1910.120).

         (e) Will include provision for medical surveillance (paragraph (f) of 1910.120).

         (f) Will include the frequency and types of air monitoring, personal monitoring, environmental sampling techniques, instruments to be used (their maintenance and calibration).

         (g) Will include a site control program (per paragraph (d) of 1910.120) to be coordinated with the installation.

         (h) Will include a decontamination procedure (per paragraph (k) of 1910.120).

         (i) Will include an emergency response plan (per paragraph (1) of 1910.120).

         (j) Will include a confined space entry procedure (per 1910.146, 147 or program equivalent).

         (k) Will include provision for spill containment (per paragraph (j) of 1910.120).

         (l) Will include pre-entry briefings (prior to each site task activity) for all employees involved in the task, supervision, or emergency response.

         (m) Written verification of adherence to the “plan” by a Safety and Health Supervisor is required (the supervisor must meet the 1910.120 training requirements for supervisors).

         (n) Deficiencies will be corrected immediately upon discovery and after consultation with the EXCHANGE Contracting Officer and Installation Safety Office.
d. Hazard Response Plan: The unplanned or non-predicted discovery of such hazards as transite pipe, contaminated soils, and other possible hazards will be addressed within an Emergency Response Plan (EMR) by all contractors. This requirement will be coordinated through the Health and Safety Program of the military installation by the contractor (sample provided).

e. Material Safety Data Sheets will be maintained at the site for all hazardous materials in use.

1.5 MONTHLY SAFETY MEETINGS

A. The Installation will schedule subsequent safety meetings with Contractor and subcontractor personnel on a monthly basis. The Owner's representative and installation will attend periodically. Minutes of safety meetings shall be prepared and signed by the Contractor. Concurrence signed by Inspection Section and the original submitted to the Contracting Officer for inclusion in the contract file.

1.6 ACCIDENT REPORTING AND RECORD KEEPING

A. Accident reporting and record keeping shall be in accordance with Base requirements. Telephonic reports of injuries or property damage will be made as soon as possible after the incident and will be followed by a copy of an Accident Report.

1.7 LIFE OF CONTRACT REQUIREMENTS

A. The Contractor shall comply with all provisions of this section during the life of the contract.

1.8 HEAD PROTECTION (HARD HATS)

A. All work sites under this contract are designated Hard Hat Areas. The Contractor shall post the area and shall ensure that all personnel, vendors and visitors use hard hats while within the limits of the work site.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 011060
SAMPLE
SAFETY PLAN

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification and are referred to in the text by the basic designation only.

1.1 US ARMY CORPS OF ENGINEERS:
EM 385-1-1 U.S. Army Corps of Engineers Safety and Health Requirements Manual

1.2 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):
NFPA 70-1993 National Electric Code (NEC)

1.3 SOCIETY OF AUTOMOTIVE ENGINEERS (SAE):
J 994-85 Alarm, Backup, Electric-Performance, Test, and Application, Recommended Practice.

2. GENERAL: Work safety is of paramount importance. The Contractor shall comply with the Contract Clause in the Solicitation entitled ACCIDENT PREVENTION, including the U.S. Army Corps of Engineers Safety and Health Requirements Manual referred to therein in addition to the provisions of this specification.

3. SAFETY PROGRAM: The U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, and all subsequent revisions to in the Contract Clause ACCIDENT PREVENTION of this contract, are hereby supplemented as follows:

a. The Contractor shall designate an employee responsible for overall supervision of accident prevention activities. Such duties shall include:

1. Assuring applicable safety requirements are incorporated in work methods
2. Inspecting the work to ensure that safety measure and instructions are actually applied.

The proposed safety supervisor's name and qualifications shall be submitted in writing for approval to the Contracting Officer's Representative. This individual must have prior experience as a safety engineer or be able to demonstrate his/her familiarity and understanding of the safety requirements over a prescribed trial period. The safety engineer shall have the authority to act on behalf of the Contractor's general management to take whatever action is necessary to assure compliance with safety requirements. The safety supervisor is required to be on the site when work is being performed.

b. Prior to commencement of any work at a job site, a preconstruction safety meeting shall be held between the Contractor and the Corps of Engineers Area/Resident Engineer to discuss the Contractor's safety program and in particular to review the following submittals:

1. Contracts Accident Prevention Plan: An acceptable accident prevention plan, written by the prime contractor for the specific work and implementing in detail the pertinent requirements of EM 385-1-1, shall be submitted for Government approval.
2. Activity Phase Hazard Analysis Plan: Prior to beginning each major phase of work, an activity hazard analysis (phase plan) shall be prepared by the Contractor for that phase of work and submitted to the Contracting Officer's Representative for approval. A phase is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new subcontractor or work crew is to perform work. The analysis shall address the hazards for each activity performed in the phase and shall present the procedures and safeguards necessary to eliminate the hazards or reduce the risk of an acceptable level.

c. Subsequent jobsite safety meetings shall be held as follows:

1. A safety meeting shall be held at least once a month for all supervisors on the project to review past activities, to plan ahead for new or changed operations and to establish safe working procedures to anticipate hazards. An outline report of each monthly meeting shall be submitted to the Contracting Officer's Representative.

2. At least one safety meeting shall be conducted weekly, or whenever new crews begin work, by the appropriate field supervisors or foreman for all workers. An outline report of the meeting giving date, time, attendance, subjects discussed and who conducted it shall be maintained and copies furnished the designated authority on request.

4. ACCIDENTS: Chargeable accidents are to be investigated by both Contractor personnel and the Contracting Officer.

4.1 ACCIDENT REPORTING, ENG FORM 3394: Section I, paragraph 01.D, of EM 385-1-1 and the Contract Clause entitled ACCIDENT PREVITION are amended as follows: The prime Contractor shall report on Eng Form 3394, supplied by the Contracting Officer, all injuries to his employees or subcontractors that result in lost time and all damage to property and/or equipment in excess of $2,000 per incident. Verbal notification of such accident shall be made to the Contracting Officer within 72 hours following such accidents. The written report shall include the following:

a. A description of the circumstances leading up to the accident, the cause of the accident, and corrective measures taken to prevent recurrence.

b. A description of the injury and name and location of the medical facility giving examination and treatment.

c. A statement as to whether or not the employee was permitted to return to work after examination and treatment by the doctor, and if not, an estimate or statement of the number of days lost from work. If there have been days lost from work, state whether or not the employee has been re-examined and declared fit to resume work as of the date of the report.

4.2 OSHA Requirements:

4.2.1 OSHA Log: A copy of the Contractors' OSHA Log of Injuries shall be forwarded monthly to the Contracting Officer.

A. The Contractor shall comply with all provisions of this section during the life of the contract.

4.2.2 OSHA Inspections: Contractors shall immediately notify the Contracting Officer when an OSHA Compliance Official (Federal or State Representative) presents his/her credentials and informs the Contractor that the workplace will be inspected for OSHA compliance. Contractors shall also notify the Contracting Officer upon determination that an exit interview will taken place upon completion of an OSHA inspection. (NABSA).

5. SUBMITTALS FOR GOVERNMENT APPROVAL: Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures”. All required submittals of items specified in this section shall be for information
only, except for those items including, but not limited to, the following which shall be submitted for Government approval:

a. Written designation of safety representative.

b. Written project specific accident prevention plan.

c. Written activity phase hazard analysis plan.

END OF SAMPLE SAFETY PLAN
SAMPLE

CONSTRUCTION HAZARD PLAN

TO BE ACCOMPLISHED BY THE GENERAL CONTRACTOR FOR CONSTRUCTION AND POSTED IN ALL CONSTRUCTION TRAILERS

SHOULD AN UNPREDICTED DISCOVERY OF A HAZARDOUS MATERIAL OR CONDITION BE MADE DURING CONSTRUCTION THE FOLLOWING SEQUENCE OF ACTIONS IS REQUIRED WHEN THERE IS NO IMMEDIATE THREAT TO LIFE OR PROPERTY

<table>
<thead>
<tr>
<th>ITEM</th>
<th>FIRST ACTION</th>
<th>NOTIFY</th>
<th>TELEPHONE #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transite Pipe</td>
<td>Crease Activity in area of discovery</td>
<td>1. BCE</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. AAFES Contracting Officer and/or CME</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. AAFES Environmental Engineer when Unable to Contact 1,2</td>
<td></td>
</tr>
<tr>
<td>Contaminated Soil</td>
<td>Crease Activity in area of discovery cover with plastic</td>
<td>Same as above</td>
<td></td>
</tr>
<tr>
<td>Buried Munitions</td>
<td>Crease Activity in area of discovery</td>
<td>Same as above</td>
<td></td>
</tr>
<tr>
<td>UST</td>
<td>Same as above</td>
<td>Same as above</td>
<td></td>
</tr>
</tbody>
</table>

Other
Should there be an immediate threat to life or property, the emergency response plan for the installation, which is to be on file at the construction side, is to be followed in every detail. An example of this procedure is the rupture of a fuel line, liquid or natural gas.

END OF SAMPLE CONSTRUCTION HAZARD PLAN
SECTION 01 13 00
SAFETY REGULATIONS AND CODES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Reference Standards.
B. Licenses and Permits
C. Safety.
D. Fire Safety.
E. Affirmative Procurement Program
F. Industrial Ventilation
G. Use of Ionizing Radiation (IR).
H. Use of Lasers.
I. Use of Radioactive Materials
J. Use of Radio Frequency (RF) Radiation.
K. Use of Ultraviolet (UV) Radiation.
L. Protection of Nesting Birds
M. Historical or Cultural Artifacts
N. Ozone Depleting Substances.
O. Lead Base Paint.
P. Cleaning & Debris Control
Q. Nuisance Dumping & Polluting Activities
R. Stormwater Pollution Prevention
S. Excavation at IRP Sites
T. Contaminated Soil
U. Suspected Hazardous Materials
V. Oil-Filled or Impregnated Electrical Components
W. Hazardous Waste Testing
X. Hazardous Material Inventory
Y. Spill Response and Reporting
Z. Waste Disposal and Environmental Protection.

1.2 REFERENCE STANDARDS

A. Federal, State and Local Codes and Ordinances take precedence over these Specifications and Drawings where conflicts occur, unless the Drawings or Specifications call for more stringent requirements. Notify the Contracting Officer in writing of conflicts.

B. Comply with all applicable laws, building and construction codes, OSHA Safety and Health Regulations and applicable requirements of any governmental agency under whose jurisdiction this Work is being performed.

C. Obtain a copy of standards referenced in the various Specification Sections. Maintain a copy at the jobsite during execution of Work to which the standard applies.

D. Construction that is not governed by the contract specifications will be governed by the more stringent provisions of the latest published edition or statute adopted edition, of the following applicable codes, regulations and standards.

ADA Americans With Disabilities Act Accessibility Guidelines
AFR Air Force Regulations
ASME American Society of Mechanical Engineers
CFR Code of Federal Regulations
FAR Federal Acquisition Regulations
IBC International Building Code
IMC International Mechanical Code
IPC International Plumbing Code
NEC National Electrical Code
NFPA National Fire Code
OSHA Occupational Safety and Health Act

Other applicable codes and standards as applicable or as referenced by the individual specification Sections.

1.3 LICENSES AND PERMITS

A. The Contractor shall obtain and maintain current for the duration of this Contract, all required Federal, State and local licenses and permits. All associated fees and taxes shall be paid by the Contractor without additional cost to the Government.
B. Obtain from base security all required vehicle and entry permits.

C. Obtain from the Contracting Officer any additional Scott AFB required permits. Current permit requirements shall be provided to the Contractor at the preconstruction conference.

1.4 SAFETY

A. Comply with all Federal and State regulations concerning safety of personnel and equipment. All Contractor personnel shall wear hard hats and steel toe safety shoes while on the project site. In addition, all personnel shall wear hearing protection (ear muffs or ear plugs) when inside the power plant, excluding office areas, restrooms, break rooms and other “quiet” areas.

B. Ensure that lock out, tag out procedures are established and used as directed by 29 CFR 1910.145. Comply with the lock out, tag out procedures in use by CH&PP personnel. Ensure that contractor’s personnel on site are trained on the government’s procedures.

C. Comply with all safety, traffic and protection requirements in effect on Scott AFB. Government will brief the Contractor on these requirements at the preconstruction conference.

D. Scott AFB Provide safety barriers around open excavations, openings in floors and other hazards created by the Contractor’s activities.

E. The Contracting Officer may direct the Contractor to cease activities which, in their opinion, are unsafe.

1.5 FIRE SAFETY

A. Comply with all fire safety and protection requirements in effect on Scott AFB Government will brief the Contractor on these requirements at the preconstruction conference.

B. Prior to beginning any welding, use of open flame device, or any activity that produces sparks, obtain a “hot work permit” from Scott AFB Fire Department. The permit shall be renewed each day welding or open flame devices will be used.

C. If the contract work requires numerous days of hot work, the Contractor may elect to have one of his on-site personnel designated as a Permit Authorizing Individual (PAI). The Contractor’s PAI may issue hot work permits at the work site, thus avoiding the requirement for daily permits issued by the Fire Department.

D. The Contractor’s PAI shall be the on-site superintendent, a foreman, the Contractor’s Safety Manager, or other individual with sufficient knowledge and experience to recognize unsafe work practices or conditions and having authority to stop work immediately if such unsafe practices or conditions are observed. To be designated as a PAI, a person must schedule and successfully complete PAI certification training offered by the Base Fire Department. PAI certification training is estimated to last 60 to 90 minutes.

E. Fire Department personnel may periodically visit the site to ensure the Contractor is complying with fire safety requirements. A PAI’s certification may be revoked if the PAI has failed to issue permits on days when hot work is performed, or if unsafe practices or conditions are observed.

F. Questions concerning these requirements may be directed to Robert Mackay, Chief, Scott AFB,

G. The Contractor shall notify the Fire Department at (phone number) 270.798.6191 a minimum of 48 hours before, and again immediately prior to, temporarily closing any street or paved building access,
interrupting water service to any fire hydrant or interrupting the operation of any fire detection, alarm or suppression system. The fire Department shall be immediately notified upon reopening closed areas, restoration of water service to any fire hydrant, or reactivation of any detection, alarm or suppression system. This notification requirement is in addition to other contract requirements.

H. Provide a 10 lb, ABC fire extinguisher at all work stations.

I. Report a fire: Dial 911.

1.6 AFFIRMATIVE PROCUREMENT PROGRAM

A. These standards apply to all new construction, demolition, rehabilitation, alteration, modification, repair, and maintenance of existing facilities.

B. In an effort to comply with the affirmative procurement requirements of Section 6002 of the Resource Conservation Recovery Act (RCRA) and Executive Order 13101, the government strongly promotes the use of the recycled and recovered materials and products identified in the Environmental Protection Agency’s Comprehensive Procurement Guidelines.

C. Recycled and recovered materials and products must be considered first before any other materials and products will be accepted. Recycled and recovered materials and products must be used throughout the project unless they either do not meet the requirements of this specification, delay the progress of the work, or are cost prohibitive.

D. Examples of these materials and products are detailed below. These are recommended quantities and represent minimum compliance. The actual requirement is to use the maximum amount of recycled material possible, while meeting the performance specifications.

<table>
<thead>
<tr>
<th>Type</th>
<th>Material</th>
<th>Recycled Material</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>Rock wool</td>
<td>Slag</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>fiberglass</td>
<td>Glass cullet</td>
<td>20-25</td>
</tr>
<tr>
<td></td>
<td>Loose fill &amp; spray on (cellulose)</td>
<td>Postconsumer paper</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Perlite composition board</td>
<td>Postconsumer paper</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Plastic rigid foam</td>
<td>Recovered material</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Foam-in place</td>
<td>Recovered material</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Glass fiber reinforced</td>
<td>Recovered material</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Phenolic rigid foam</td>
<td>Recovered material</td>
<td>5</td>
</tr>
<tr>
<td>Wall Board</td>
<td>Structural fiberboard</td>
<td>Postconsumer paper</td>
<td>80-100</td>
</tr>
<tr>
<td></td>
<td>Laminated paperboard</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Carpet</td>
<td>Polyester carpet face fiber</td>
<td>Excludes severe wear</td>
<td>25-100</td>
</tr>
<tr>
<td></td>
<td>Playground surfaces</td>
<td>applications</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Running tracks</td>
<td>Rubber or plastic</td>
<td>90-100</td>
</tr>
<tr>
<td>Cement/Concrete</td>
<td>Concrete &amp; cement</td>
<td>Coal fly ash</td>
<td>15-35</td>
</tr>
<tr>
<td></td>
<td>Concrete &amp; cement</td>
<td>Ground granulated blast furnace (GGBF)</td>
<td>25-50</td>
</tr>
<tr>
<td>Flooring/Patio</td>
<td>Patio blocks</td>
<td>Plastic or plastic blends</td>
<td>90-100</td>
</tr>
<tr>
<td></td>
<td>Patio blocks</td>
<td>Rubber or rubber blends</td>
<td>90-100</td>
</tr>
<tr>
<td></td>
<td>Floor tiles</td>
<td>Rubber</td>
<td>90-100</td>
</tr>
<tr>
<td></td>
<td>Floor tiles</td>
<td>Plastic</td>
<td>90-100</td>
</tr>
<tr>
<td>Landscaping</td>
<td>Paper based hydraulic mulch</td>
<td>Postconsumer paper</td>
<td>100</td>
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<tr>
<td></td>
<td>Wood based hydraulic mulch</td>
<td>Recovered wood and/or paper</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Compost</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
1.7 INDUSTRIAL VENTILATION

A. Contact the Contracting Officer 10 working days prior to any industrial ventilation systems (systems which control a hazard) being evaluated for acceptance. Advance notification is required by Bioenvironmental Engineering (BE) to allow performance or observation of tests of any new or renovated system prior to initial startup to verify the system will control the hazard. BE will be present for tests of fan speed and rotation, fan motor load, and air flow in all hoods or branches.

1.8 USE OF LASERS

A. Submit a written request for approval at least 30 calendar days before commencement of activities which require the use of a laser.

B. Submit request to the RSO with a courtesy copy to the Contracting Officer. Request shall include:

1. Description/Characteristics:
   a. Manufacturer.
   b. Model.
   c. Number of same units.
   d. Serial number(s).
   e. Laser medium.
   f. Mode of operation (i.e. continuous wave (CW), single pulse, multiple pulse).
   g. Maximum exposure time (train length).
   h. Ime (sec) & wave length.
   i. Energy/pulse (J) or CW power (W).
   j. Pulse repetition frequency.
   k. Pulse width.
   l. Beam diameter (at 1/e point).
   m. Beam divergence (at 1/e point).

2. The part of the EXCHANGE contract describing work to be done and the inclusive dates of such work.

3. An acknowledgment that the RSO may make initial and periodic checks to ensure the contractor is following applicable radiological health and safety practices which prevent unnecessary exposures to Post or Base personnel.

1.9 OZONE DEPLETING SUBSTANCES

A. No ozone depleting substances (refrigerants or any other compounds) shall be used in any capacity on this project unless specifically approved by the HazMart.

1.10 LEAD BASE PAINT

A. No paint with a lead content of 0.06 percent or greater shall be used in any capacity on this project unless specifically approved by the HazMart.

1.11 CLEANING AND DEBRIS CONTROL

A. During the term of this Contract, the Contractor shall remove any materials and equipment that are not required for the completion of the work as promptly as possible. All debris shall be removed
from the site and legally disposed. The Contractor shall take particular care to eliminate any hazards created by his operations.

B. The Contractor is responsible for any damage caused by his debris without additional cost to the Government.

C. The Contractor shall maintain at all times during his work at this Project Site a strict windblown debris control program. This program shall ensure no windblown debris or other debris from his work shall contaminate or interfere with any access to or operation of any facility or any parking area, road or street.

1.12 NUISANCE DUMPING AND POLLUTING ACTIVITIES

A. Polluting, dumping, or discharging of any harmful, nuisance, or regulated materials (such as concrete truck washout, vehicle maintenance fluids, residue from saw cutting operations, solid waste or hazardous substances) into building drains, site drains, streams, waterways, holding ponds or to the ground surface is not permitted. The contractor shall be responsible for any and all damages resulting from dumping or discharges. Further, the Contractor shall conduct activities in such a fashion to avoid creating any legal nuisance, including but not limited to, suppression of noise and dust, control of erosion, and implementation of other measures as necessary to minimize off site impacts of work activities.

B. Fugitive Dust emissions (airborne dust generated by vehicles operating on unpaved surfaces, transfer or transport of dust producing materials, etc.) shall be controlled at the construction site, along haul routes and at staging areas. Water spraying shall be conducted as necessary to minimize fugitive dust generation.

1.13 SUSPECTED HAZARDOUS MATERIALS

A. Any suspect hazardous materials encountered during demolition or construction shall immediately be brought to the attention of the Contracting Officer’s representative. Work shall not resume until the Contracting Officer is satisfied that the materials are not hazardous. Should they be found to be hazardous, the contractor shall immediately take steps to contain the material, so further damage and contamination does not occur. The contractor shall then submit a proposal for removal.

1.14 OIL-FILLED OR IMPREGNATED ELECTRICAL COMPONENTS

A. Notify (Post or Base Environmental Safety Office and phone number) before demolition or installation of any oil-filled electrical equipment (for example: transformers and regulators). All transformers (both PCB and non-PCB-containing) and light ballasts (unless labeled “No PCBs”) shall be disposed through the Scott AFB Hazardous Material and Waste Handling facility.

1.15 HAZARDOUS WASTE TESTING

A. The Contractor shall subject a representative sample of each type of hazardous waste, or potentially hazardous waste, generated to TCLP (Toxic Characteristic Leaching Procedure) testing. Sampling and testing for appropriate metals, and volatile and semi-volatile chemicals shall be performed by an independent test agency that is regularly engaged in the sampling and testing of hazardous materials and waste. Provide the test results to Post or Base Hazardous Waste Facility
before transferring the waste to the facility. Refer to the attached Waste Disposal and Borrow Pit Worksheet for additional hazardous waste handling requirements.

1.16 HAZARDOUS MATERIAL INVENTORY

A. Contractor must submit an inventory of all hazardous materials to be used to include quantities. Inventory must be updated at completion of the project to indicate quantities used, spilled, and disposed of, etc.

B. The Contractor shall provide the Hazardous Materials Pharmacy (HazMart) a list and quantity of all hazardous materials that the Contractor intends to bring onto Government property. The Contractor shall provide the HazMart with copies of all MSDSs and an inventory for each Hazardous chemical listed in OSHA Hazard Communication Standard 29 CFR 1910.1200 intended to be used. Each MSDS shall be on file prior to use of the chemical, and shall be maintained for all chemicals. Once the hazardous material is used, its quantity of use shall be reported to the HazMart along with the disposition of the container.

C. Submit a completed Hazardous and Related Material Identification Form, and an MSDS for all materials listed on the form and brought on Base, to the (office and phone).

D. If hazardous materials are not in their original container, the container containing the substance must be labeled.

1.17 SPILL RESPONSE AND REPORTING

A. Spills of hazardous waste, hazardous materials or non-regulated substances such as oils, antifreeze, grease, latex paint, hydraulic fluid, etc. shall immediately be reported to Scott AFB for reporting purposes to local, state and federal agencies and proper clean-up action. If a spill occurs after normal working hours, or on a weekend or holiday, report spills to the Scott AFB Fire Department.

B. The contractor is encouraged to have a supply of absorbent pads on-site to aid in immediate clean-up of smaller spills, such as oil, coolant or hydraulic fluid leaks from vehicles or equipment.

C. Spill notification placards are to be placed on the job site. Scott AFB will provide format and required locations prior to construction.

D. The contractor shall develop a spill plan. The format for the plan will be provided by DPW prior to construction.

1.18 WASTE DISPOSAL AND ENVIRONMENTAL PROTECTION

A. The Contractor shall comply, and ensure that all subcontractors comply, with all Federal, State, local laws, and regulations, ordinances and standards related to environmental pollution control and abatement in effect and the specific requirements stated elsewhere in the Contract Documents.

B. All hazardous wastes as defined in 40 CFR, Part 261, shall be collected and disposed of in accordance with 40 CFR, Parts 260-268, and Scott AFB. The Contractor is responsible for properly storing, marking, labeling, securing and transporting hazardous wastes. All hazardous wastes shall be collected in contractor furnished DOT/UN approved containers and taken to Scott AFB Hazardous Waste Facility for disposal. Call the Hazardous Waste Facility prior to
transporting wastes to the facility to coordinate delivery of the waste materials. The Contractor shall not store hazardous waste on base for more than 30 days.

C. Any previously unidentified suspected hazardous materials encountered during performance of the work of the contract shall immediately be brought to the attention of the Contracting Officer.

D. All general construction wastes, other than those specifically allowed, or required, to be disposed of on-base shall be legally disposed at an off-base sanitary landfill.

E. Comply with the requirements of Scott AFB “Waste Disposal” immediately following this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 13 00
Scott AFB

WASTE DISPOSAL

The Contractor shall obtain all permits required by federal, state and local laws for the construction activities involved. The Contractor shall perform all work in such a manner as to minimize the polluting of air, water or land and shall, within reasonable limits, control noise and the disposal of solid waste materials, as well as other pollutants. The Contractor shall ensure that all construction, repair, maintenance operations and practices and waste disposal performed under this contract shall be in strict compliance with all applicable city, county, state and federal environmental laws and regulations.

1. Hazardous and Non-hazardous Waste Disposal: There are no known existing sources of hazardous waste involved with this project. If the Contractor generates or discovers suspected hazardous waste it shall be brought to the immediate attention of the Contracting Officer for review and direction on how to proceed with handling and disposal. As part of the proposed implementation above and prior to on-site construction, the Contractor shall submit for approval, a plan for storing, characterizing and disposing of hazardous and non-hazardous waste materials resulting from the work under this contract. Waste includes, but is not limited to, paint waste, paint equipment cleaners and used paint containers. If any waste material is dumped in unauthorized areas, the Contractor shall remove the materials and restore the area to the condition of the adjacent undisturbed areas. Where directed and approved by the Contracting Officer, contaminated ground shall be excavated, characterized, stored, disposed of and replaced with suitable fill material at the expense of the Contractor. All waste disposal shall be in strict accordance with local, state and federal requirements and regulations. Waste paint, paint equipment cleaners and used paint containers shall be disposed of off base by the Contractor, at the Contractors’ expense. Any soil contaminated through spillage shall be removed and disposed of in accordance with the requirements specified herein. Soil that is required to be removed shall be replaced by similar soil approved by the Contracting Officer.
SECTION 01 14 20
CONSTRUCTION PHASING

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Format.
B. Content.
C. Submittals.

1.2 RELATED SECTIONS
A. Exhibit “A” - General Conditions of the EXCHANGE Contract for Construction, Article entitled: “Schedule and Progress”.
B. Section 01 10 00 - Summary
C. Section 01 33 00 - Submittals: Construction Progress Schedules.
D. Section 01 31 00 - Progress Management and Coordination.

1.3 GENERAL
A. The construction phasing shall serve as a guide in managing the construction progress.
B. In preparing this system, the scheduling of construction shall be the responsibility of the contractor.

1.4 COORDINATION
C. Beneficial occupancy inspection (finishes only) will be made at the end of each work item, to allow early access for fixture installations.
D. Phasing: All phases shall be included in the contract performance period.

1.5 BARRIERS:
A. Building areas adjacent to areas to be renovated will not be vacated by the Exchange; therefore, barriers shall be erected by the Contractor as work progresses. Provide barriers as specified in Section 01 50 50 Temporary Facilities, Barriers and Controls in the locations indicated, and as required, from floor to ceiling or from floor to underside of roof deck, to seal operational portions of the retail facility from areas of construction. Security walls, however, shall be secured up to the bottom of roof deck. Temporary barriers exposed to customer view shall be painted with two coats of color as approved by the Contracting Officer.

1.7 GENERAL:
A. Electrical Systems:
   1. Install electrical distribution and telephone to existing construction.
2. All of the above work shall be completed without disruption of exchange operation during normal business working hours.

B. Electrical Security Systems:

1. Temporarily modify the alarm system to allow access during working hours to the temporary entrances.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 14 20
SECTION 01 14 50
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Requirements and limitations for cutting and patching of Work.

1.2 RELATED SECTIONS
   A. Section 01 10 00 - Summary.
   B. Section 01 33 00 - Submittals.
   C. Individual Product Specification Sections:
      1. Cutting and patching incidental to work of the section.
      2. Advance notification to other sections of openings required in work of those sections.
      3. Limitations on cutting structural members.

1.3 SUBMITTALS
   A. Submit written request in advance of cutting or alteration which affects:
      1. Structural integrity of any element of Project.
      2. Integrity of weather exposed or moisture resistant element.
      3. Efficiency, maintenance, or safety of any operational element.
      5. Work of EXCHANGE or separate contractor.
   B. Include in request:
      1. Identification of Project.
      2. Location and description of affected Work.
      3. Necessity for cutting or alteration.
      4. Description of proposed Work and Products to be used.
      5. Alternatives to cutting and patching.
      6. Effect on work of EXCHANGE or separate contractor.
      7. Written permission of affected separate contractor.
      8. Date and time work will be executed.

PART 2 – PRODUCTS

2.1 MATERIALS
   A. Primary Products: Those required for original installation.
PART 3 – EXECUTION

3.1 EXAMINATION
A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.
B. After uncovering existing Work, assess conditions affecting performance of work.
C. Beginning of cutting or patching means acceptance of existing conditions.

3.2 PREPARATION
A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.
B. Provide protection from elements for areas which may be exposed by uncovering work.

3.3 CUTTING
A. Execute cutting and fitting to complete the Work.
B. Uncover work to install improperly sequenced work.
C. Remove and replace defective or non-conforming work.
D. Remove samples of installed work for testing when requested.
E. Provide openings in the Work for penetration of electrical work.
F. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.4 PATCHING
A. Execute patching to complement adjacent Work.
B. Fit Products together to integrate with other Work.
C. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.
D. Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.
E. Restore work with new Products in accordance with requirements of Contract Documents.
F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element.
H. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION 01 14 50
SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY
A. Section includes administrative and procedural requirements for unit prices.

1.3 DEFINITIONS
A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES
A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
C. Owner reserves the right to reject Contractor’s measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
D. List of Unit Prices: A schedule of unit prices is included below in Part 3, EXECUTION. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price 1: Interior concrete slab repairs and joint filler replacements.
   1. Description: See Section 03 35 40 Interior Concrete Slab Repairs and Joint Filler Replacement.
   2. Unit of Measurement: Linear feet and unit price.

END OF SECTION 01 22 00
SECTION 01 23 00

OPTIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. Options: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each option is the net addition to or deduction from the Contract Sum to incorporate option into the Work. No other adjustments are made to the Contract Sum.

1.2 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the option into Project.

1. Include as part of each option, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of the options.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each option. Indicate if options have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to options.

C. Execute accepted options under the same conditions as other work of the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF OPTIONS

A. Option No. 1: Refinishing MCS.

B. Option No. 2: Enclosing ODL.

END OF SECTION 01 23 00
SECTION 01 25 00

SUBSTITUTION PROCEDURES

1.1 ACTION SUBMITTALS

A. Documentation:

1. Justification.
2. Coordination information.
3. Detailed comparison.
4. Product Data.
5. Samples.
6. Certificates and qualification data.
7. List of similar installations.
8. Material test reports.
9. Research reports.
10. Detailed comparison of Contractor's construction schedule.
11. Cost information.
12. Contractor's certification.
13. Contractor's waiver of rights to additional payment or time.

1.2 CONTRACTING OFFICERS APPROVAL

A. The contract is based on materials and methods described in the contract document.

B. The Contracting Officer will consider proposals for substitution of materials, equipment and methods only when such proposals are accompanied by full and complete technical data and all other information required by the Contracting Officer to evaluate the proposed substitution.

C. Do not substitute materials or equipment, unless such substitution has been specifically approved for this Work by the Contracting Officer.

D. Requests for substitution shall be made no less than 10 days prior to proposal closing date. No further substitutions will be permitted after contract award.

E. Where the phrase “or equal” or “or equal as approved in advance by the Contracting Officer” occurs in the Contract Documents, do not assume that material and equipment will be approved as equal by the Contracting Officer unless the item has been specifically approved for this work by the Contracting Officer. All requests for “or equal” or “equal as approved in advance by the Contracting Officer” must be submitted 10 days prior to proposal closing date.

F. The decision of the Contracting Officer shall be final.

1.3 SUBSTITUTIONS FOLLOWING AWARD OF CONTRACT

A. Substitutions for Cause: Not later than 15 days prior to time required for preparation and review of submittals. The submittal must include a justification explaining the rational for the requested substitution. The contractor shall be liable for costs of the Contracting Officer’s review for Contractors failure to order materials, equipment, e.g. in sufficient time.
B. Substitutions for Convenience: Not allowed after contract award.

1.4 AVAILABILITY OF SPECIFIED ITEMS

A. Verify prior to bidding that all specified items will be available in time for installation during orderly and timely progress of the Work.

B. In the event specified item or items will not be so available, notify the Contracting Officer 10-days prior to receipt of proposals with a recommended replacement item.

C. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, will be back-charged as necessary and shall not be borne by EXCHANGE.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 25 00
PART 1 - GENERAL

1.1 REQUESTS FOR INFORMATION (RFIs)

A. Architect's Action: Allow seven working days for Architect's response for each RFI.

B. RFI Log: Maintain a tabular log of RFIs. Submit log weekly.

1.2 PRECONSTRUCTION MEETING

A. The Contracting Officer and/or Contracting Officer's representative will schedule and preside at precon-
struction meeting.

B. Attendance Required:

1. Contracting Officers and/or Contracting Officer's representative and other Headquarters
   EXCHANGE representatives.
2. Local and regional EXCHANGE representatives.
3. Installation representative (Engineering, Fire Marshall, Security, etc.)
4. Contractor
5. Major Sub-contractors

C. Agenda:

1. Execution of Notice to Proceed.
3. Submission of list of sub-contractors.
4. Review of EXCHANGE checklist of contract requirements.
5. Discussion of Schedule.
6. Discussion of critical sequencing.
7. Designation of responsible personnel.
8. Processing of field decisions and change orders.
9. Submission of applications for payment.
10. Submittal of shop drawings.
11. Procedures for maintaining record documents.
12. Fire and safety procedures.
15. Housekeeping procedures.
16. Use of premises

   a. Office and storage locations.
   b. Personnel parking.

17. Major equipment deliveries.
18. Other issues pertinent to completing the contract.
D. Meeting minutes: Minutes will be taken by the A/E and distributed to EXCHANGE, Contractor, and Installation Engineer.

1.3 PROGRESS MEETINGS

A. The contractor shall schedule and preside at monthly progress meetings.

B. The contractor shall make arrangements for meetings, prepare agenda with copies for participants.

C. Location of Meetings: Construction office, or as directed in the notice.

D. Attendance Required:

1. Contractor's project manager.
2. Contractor's superintendent.
3. Major sub-contractors and suppliers.
4. EXCHANGE representative (EXCHANGE’ option).

E. Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Coordination of projected progress.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to work.

F. Meeting Minutes: A/E shall record meeting minutes, and distribute copies to the participants (including the EXCHANGE Contracting Officer, within three (3) business days of the meeting.

1.4 PROJECT MEETINGS

A. The Contractor shall schedule and preside at other project meetings when required.

B. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and EXCHANGE’ Commissioning Authority of scheduled meeting dates.

2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

   b. Options.
   c. Related RFIs.
   d. Related Change Orders.
   e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer’s written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 00
SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Format
B. Content
C. Revisions to schedules
D. Submittals

1.2 RELATED SECTIONS
A. General Provisions of the EXCHANGE Contract for Construction, Article entitled: "Schedule and Progress"
B. Section 01 10 00 - Summary
C. Section 01 33 00 - Submittals

1.4 GENERAL
A. The Contractor-prepared progress chart shall serve as a guide in managing the construction progress.
B. In preparing this system, the scheduling of construction shall be the responsibility of the Contractor.
C. The schedules shall be prepared using the Critical Path Method (CPM).

1.4 FORMAT
A. Prepare schedules as a horizontal bar chart with separate bar for each major portion of work or operation, identifying first workday of each week.
B. The format shall be such to enable the Contracting Officer to evaluate the reasonableness of the proposed schedule and to determine if the actual construction is on schedule.

1.5 CONTENT
A. Show complete sequence of construction by activity with dates for beginning and completion of each element of construction.
B. Identify each item by specification section number.
C. Show accumulated percentage of completion of each item and total percentage of Work completed as of the first day of each month.
D. Indicate delivery dates for EXCHANGE furnished products.
1.6 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope and other identifiable changes which could affect the schedule.

C. Provide narrative report with each submittal describing work accomplished during the previous period, the work scheduled for the next period, anticipated problem areas and delays and impact on the schedule. Report corrective action taken or proposed.

1.7 SUBMITTALS

A. Submit a preliminary schedule through the Contracting Officer defining the Contractor's proposed operations for the first sixty (60) of the contract within ten (10) days after date of Notice to Proceed. Indicate the Contractor's general approach for the balance of the project. Include the cost of the activities expected to be completed or partially completed before submission and approval of the complete progress schedule.

B. Upon approval of the preliminary schedule by the Contracting Officer and within thirty (30) calendar days after the Notice to Proceed, the Contractor shall submit the complete Progress Schedule.

C. Submit revised Progress Schedules with each monthly Application for Payment.

D. Submit the number of opaque reproductions which Contractor requires plus four (4) copies which will be retained by Contracting Officer.

1.8 DISTRIBUTION

A. Distribute copies of reviewed schedules to project site file, subcontractors, suppliers and other concerned parties.

B. Instruct recipients to promptly report in writing, problems anticipated by projections indicated in schedules.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 32 00
SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.
B. Construction progress schedules.
C. Shop Drawings.
D. Samples.
E. Product Data.
F. Certificates.

1.2 RELATED SECTIONS

A. Section 01 10 00 - Summary.
B. Section 01 32 00 - Construction Progress Schedules
C. Section 01 78 39 - Project Record Documents.

1.3 SUBMITTAL PROCEDURES

A. Transmit each submittal with EXCHANGE Form 4450-48, Shop Drawings and Material Approval Submittal.
B. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
C. Identify Project, Contractor, subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate.
D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
E. Schedule submittals to expedite the Project. Transmit submittals to Contracting Officer. Coordinate submission of related items.
F. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work. Failure to identify such variations will not relieve the Contractor of the responsibility for completing the work in full accordance with the Contract Documents even though such submittals are approved by the Contracting Officer.
G. Prior to approval of the material/product submitted, the contractor shall include with the submittal a written certification that the material/product contains no asbestos. This certificate is mandatory before approval will be issued.

H. Provide space for Contractor and Contracting Officer review stamps.

I. When revised for resubmission, identify all changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

1.4 CONSTRUCTION PROGRESS SCHEDULES

A. Submit preliminary Progress Schedule within ten (10) days of the Notice to Proceed.

B. Submit complete (final) Progress Schedule within thirty (30) days of the Notice to Proceed.

C. Submit monthly revisions of Progress Schedule.

D. Refer to Section 01 32 00 - Construction Progress Documentation, for submittal information.

1.5 SHOP DRAWINGS

A. Shop Drawings For Review:
   1. Submitted to Contracting Officer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
   2. Shop drawings shall be prepared by a qualified detailer.
   3. Minimum sheet size for shop drawings shall be 8 1/2” x 11”.
   4. After review, and distribute copies in accordance with Submittal Procedures article above and for record documents purposes described in Section 01 77 00 - Project Closeout.

B. Shop Drawings For Project Close-out:
   1. Submitted for the EXCHANGE's benefit during and after project completion.

C. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
   1. Submit the number of opaque reproductions which Contractor requires, plus three (four on structural, mechanical, and electrical submittals) copies which will be retained by Contracting Officer.

1.6 SAMPLES

A. Samples For Review:
   1. Submitted to Contracting Officer for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
2. After review, produce duplicates and distribute in accordance with Submittal Procedures article above and for record documents purposes described in Section 01 77 00 - Project Closeout.

B. Samples For Information:

1. Submitted for the Contracting Officer’s knowledge as project administrator or for EXCHANGE.

C. Samples For Selection:

1. Submitted to Contracting Officer for aesthetic, color, or finish selection.
2. Submit samples of finishes from the full range of manufacturers' standard colors, or in custom colors (if so stated in the product specification section), textures, and patterns for Contracting Officer selection.
3. After review, distribute in accordance with Submittal Procedures article above and for record documents purposes described in Section 01 77 00 - Project Closeout.

D. Submit samples to illustrate functional and aesthetic characteristics of the Product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

E. Include identification on each sample, with full Project information.

F. Submit the number of samples specified in individual specification sections; two of which will be retained by Contracting Officer.

G. Reviewed samples which may be used in the Work are indicated in individual specification sections.

H. Coordinate sample submittals with respective shop drawings.

1.7 PRODUCT DATA

A. Submit Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, specifications, illustrations, and other descriptive data.

B. Product data that relates to shop drawings or samples must be submitted with the respective shop drawings or samples.

1.8 CERTIFICATES

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the Contractor to Contracting Officer, in quantities specified for Product Data.

B. Certify that material or Product conforms to or exceeds specified requirements. Submit supporting reference data, test results, affidavits, and/or certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.
1.9 LIMITATIONS AND CONTRACTOR’S RESPONSIBILITIES

A. Submittals will be reviewed for the limited purpose of checking for conformance with the design concept and the information shown in the drawing and specifications. These reviews shall not include review of the accuracy for completeness of details. A review shall not indicate that the reviewer has checked the entire system of which the reviewed item is a component. The reviewer shall not be required to review partial submissions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 33 00
SECTION 01 33 10

WEATHER TABLE

PART 1 - GENERAL

1.1 INFORMATION AND DATA

A. Information and data furnished or referred to in the weather table is furnished for the Contractor's information.

1.2 CONTRACT TIME LIMITS

B. The contract time limits include weather conditions that are shown in the table listed herein.

1.3 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

A. This provision specifies the procedure for the determination of time extensions for unusually severe weather affecting exterior work in accordance with the Contract. The following listing defines the monthly anticipated adverse weather for the contract period and is based on NOAA data for the geographic location of the project.

B. Weather Table:

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS
Scott AFB

<table>
<thead>
<tr>
<th>JUN</th>
<th>JUN</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEPT</th>
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</table>

This listing of anticipated adverse weather will constitute the base line monthly weather time evaluations. Throughout the contract each month, actual adverse weather days will be recorded on a calendar basis (including weekends and holidays) and compared to the monthly anticipated adverse weather in this listing. The term "actual adverse weather days" shall include days impacted by actual adverse weather. The number of actual adverse weather days affecting exterior work shall be calculated chronologically from the first to the last day in each month. Adverse weather days must prevent work for 50 percent or more of the contractor's work day and delay work critical to the timely completion of the project. If the number of actual adverse weather days exceeds the number of days anticipated in the above listing, the Contractor may submit in writing to the Contracting Officer a request for a time extension within 30 days of the adverse weather. Based upon the above NOAA data the Contracting Officer will determine if the time extension for the Contractor is warranted. The Contracting Officer will then convert any qualifying delays to calendar days and issue a modification in accordance with the contract. Any Time extensions granted under this provision will be at no cost to the EXCHANGE.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES (Scope)

A. The work covered by this section consists of furnishing all labor, materials, and equipment and performing all work required for the prevention of environmental degradation during and as a result of construction operations under this contract. These requirements are in addition to any environmental protection requirements elsewhere in these specifications. For the purpose of this specification, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents, not naturally occurring at the site, which adversely affect human health or welfare; unfavorably alter ecological balances important to human life; affect other species of importance to humans; or degrade the utility of the environment for aesthetic and recreational purposes. The control of environmental pollution by the contractor requires consideration of air, water, and land, and involves noise control, solid waste management and management of radiant energy and radioactive materials, as well as other pollutants. This section also requires the protection of cultural and historic resources.

B. Contractor shall coordinate the work of this section with the work called for under the various Earthwork and Utilities sections.

1.2 CONTRACTOR'S GENERAL ENVIRONMENTAL COMPLIANCE OBLIGATIONS.

Work under this contract is to be performed on a government facility. All environmental rules applying to contractor operations elsewhere will also apply on the government facility. Contractor (and any subcontractor, agent or representative) shall comply with all Applicable Federal, State, and local laws and regulations providing for environmental protection and pollution control and abatement. These include but are not limited to: the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Coastal Zone Management Act, Endangered Species Act, National Historic Preservation Act, Safe Drinking Water Act, Emergency Planning and Community Right-to-Know Act, Oil Pollution Act, Archeological Resources Protection Act, and Pollution Prevention Act. Contractor has the duty to determine for itself where such laws and regulations apply. Although the Contractor may request assistance from the Contracting Officer in delineating applicable environmental laws and regulations, Contractor has an independent responsibility to make its own determination and to do so in a timely fashion.

1.3 FINES OR PENALTIES FOR ENVIRONMENTAL NON-COMPLIANCE.

The Contractor shall be responsible for paying any fines or penalties assessed against EXCHANGE or the installation or the Army or the Air Force for violations of environmental laws or regulations resulting from acts or omissions of the contractor or its employees, subcontractors, or agents. This obligation is in addition to any fines or penalties that may be assessed against the contractor for the same conduct. Contractor may either reimburse these fines or penalties through the Contracting Officer, or with the consent of the Contracting Officer, the Contractor may pay such fines or penalties directly to the regulatory agency or agencies concerned.
1.4 CONTRACTOR'S LIABILITY FOR ENVIRONMENTAL DAMAGES

Contractor agrees to hold harmless and indemnify EXCHANGE (which includes the Army, Air Force, or other Department of Defense component, as appropriate) for any and all damages of any kind resulting from environmentally harmful activities by the contractor, contractor's employees or agents or subcontractors. "Damages" includes but is not limited to personal injury, property damage (including diminution of value), or death, environmental restoration and response costs, natural resource damages, expert witness and attorney's fees, and reimbursement of any and all expenses incurred to obtain permits as a result of Contractor's failure to identify or obtain permits for itself or EXCHANGE.

1.5 CONTACTS WITH ENVIRONMENTAL REGULATORY OFFICIALS.

Contractor shall immediately advise the Contracting Officer and the installation environmental office of the content of all contacts with federal, state, or local environmental regulators, before, during, and after the performance of this contract concerning the performance of this contract.

PART 2 - PERMITS

2.1 PERMITS FOR EQUIPMENT USED BY CONTRACTOR IN PERFORMING EXCHANGE CONTRACTS.

For equipment used in the performance of this contract, Contractor shall obtain in Contractor's name and at no additional expense to EXCHANGE, all permits, coordinations, certifications or other regulatory authorization necessary to perform and complete the work required by this contract under applicable environmental laws and regulations. "Applicable environmental laws and regulations" includes but is not limited to: the Clean Air Act, Clean Water Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Toxic Substances Control Act, Federal Insecticide Fungicide and Rodenticide Act, Coastal Zone Management Act, Endangered Species Act, National Historic Preservation Act, Safe Drinking Water Act, Emergency Planning and Community Right-to-Know Act, Oil Pollution Act, and Pollution Prevention Act and State, County, and Local laws and regulations on the same subjects.

2.2 PERMITS NEEDED FOR CONSTRUCTION, EXCAVATION, MODIFICATION, RENOVATION, DEMOLITION, INSTALLATION, OR OTHER ALTERATION OF BUILDINGS, STRUCTURES, EQUIPMENT, INSTALLATIONS, REAL PROPERTY OR SYSTEMS

Contractor shall identify all Federal, State, County, or local, permits, coordinations, certifications or other regulatory authorization requirements under all applicable environmental laws and regulations as defined in (a.) above. Contractor shall then prepare and submit in draft all applicable permit applications, coordinations, notices, or other required filings, together with all supporting data to the contracting officer for review. Permit applications or notifications or other documents that must be submitted by EXCHANGE will be submitted by EXCHANGE, and any documents that must be submitted by the contractor will be returned after review to the contractor for submission. No work requiring permit or other written authorization shall proceed before the Contractor has the permit or authorization or a copy thereof in its possession.
PART 3 - MATERIALS

3.1 RECYCLED MATERIALS.

Materials used in this contract shall be, to the greatest extent practicable and consistent with financial prudence, made of recycled materials or of materials that are recyclable. Where construction debris such as concrete or asphalt or wood can be recycled, this alternative will be considered.

3.2 ASBESTOS

Asbestos will not be used or included in this project.

3.3 POLYCHLORINATED BIPHENYL'S (PCBs)

PCBs will not be used or included in this project.

3.4 LEAD-BASED PAINT

Lead-based paint will not be used included in this project.

3.5 OZONE-DEPLETING SUBSTANCES.

A. "Class I substance," as used in this clause, means any substance designated as class I by the Environmental Protection Agency (EPA)(40 CFR Part 82), including but not limited to chlorofluorocarbons, halons, carbon tetrachloride, and methyl chloroform.

B. "Class II substance," as used in this clause, means any substance designated as class II by EPA (40 CFR Part 82), including but not limited to, hydrochlorofluorocarbons.

C. As required by 42 USC 7671j(b), c, and (d) and 40 CFR Part 82, Subpart E, the Contractor shall label products which contain class I or class II ozone-depleting substances or are manufactured with a process that uses class I or class II ozone-depleting substances, or containers of class I or class II ozone-depleting substances, as follows:

"WARNING: Contains (or manufactured with, if applicable) _______*_____, (a) substance(s) which harm(s)public health and the environment by destroying ozone in the upper atmosphere."

*The Contractor shall insert the name of the substance(s).

D. The contractor shall comply with the applicable requirements of Sections 608 and 609 of the Clean Air Act (42 USC 7671g, National Recycling and Emission Reduction Program and 7671h, Servicing of Motor Vehicle Air Conditioners) as each or both apply to the contract.

3.6 PESTICIDES

Except as may be specified elsewhere in this contract, Contractor will not use or apply pesticides (such as herbicides or weed-killers, insecticides, or rodenticides) without the specific written prior approval of the Contracting Officer.
PART 4 - EXECUTION (WORK PRACTICES)

4.1 GENERAL: SITE DISTURBANCE DURING CONSTRUCTION ACTIVITIES.
Contractor shall use industry-recognized best management practices to avoid creation of fugitive dust emissions and to avoid and control storm water runoff from the construction site and any temporary roads that may be used for access to it. Water sprinkling may be used to control dust. Contractor shall perform all work under this contract in such a manner that no pollutants of any kind are released into ditches, storm drains, streams, lakes, or other surface waters on or connected to the site.

4.2 PROTECTION OF WATER RESOURCES

A. General: The General Contractor shall not pollute storm drainage, streams, lakes, or reservoirs with fuels, oils, bitumens, calcium chloride, acids, construction wastes or other harmful materials or pollutants. It is the responsibility of the General Contractor to determine and comply with all applicable federal, state, regional, municipal, and other regulations.

B. Spillage: The General Contractor shall take special measures to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides, cement, and surface drainage from entering public waters. In the event of a spill, the contractor must make all required notifications to federal, state or local authorities and will notify the Contracting Officer immediately.

C. Washing and Curing Water: Water used in aggregate processing, concrete curing, foundation, and concrete lift clean-up and other waste water shall not be allowed to enter the storm drainage system.

4.3 PROTECTION OF LAND RESOURCES

A. General: It is intended that the land resources within the project boundaries and outside the limits of permanent work performed under this contract be preserved in their present condition or be restored to a condition after completion of construction that will appear to the natural and not detract from the appearance of the project. The General Contractor shall limit his construction activities to areas defined by the Drawings or Specifications.

B. Prevention of Landscape Defacement: Except in areas marked on the plans to be cleared, the General Contractor shall not deface, remove, cut, injure or destroy trees or shrubs without specific written authority. Trees designated to be saved shall be protected from either excavation or filling within the root zone. No ropes, cables, or guys shall be fastened or attached to any existing trees for anchorage unless specifically authorized by the Contracting Officer. The General Contractor shall in any event be responsible for any damage resulting from such use.

C. Restoration of Landscape Damage: Any trees or other landscape features scarred or damaged by the General Contractor's equipment or operations shall be restored as nearly as possible to the original condition at the General Contractor's expense. The Contracting Officer will decide what method of restoration shall be used, and whether damaged trees shall be treated and healed or removed and disposed of under requirements for clearing and grubbing. All scars made on trees not designated on the plans to be removed by equipment construction operations, or by the removal of limbs larger than 1-inch in diameter shall be coated immediately with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced landscape personnel. Tree trimming with axes shall not be permitted. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the General Contractor and are beyond saving in the opinion of the Contracting Officer, shall be immediately removed and replaced with a nursery-grown tree of the same species.

4.4 CONTROL OF AIR EMISSIONS.
Contractor's actions shall conform to all federal, state, and local requirements for the control of air emissions during work under this contract. Trucks leaving the site will be brushed or washed to remove all practicable amounts of dust or other material that may become airborne. Contractor will ensure that all
internal construction vehicles and equipment used will have the lowest practicable emissions characteristics and be maintained in optimum operating condition for the reduction of air emissions. Where use of electric motors instead of internal combustion engines is feasible, electric motors will be used during construction.

PART 5 – POLLUTION PREVENTION AND WASTE DISPOSAL

5.1 POLLUTION PREVENTION

The contractor should use prior planning to find those materials that will minimize the creation of waste in general and hazardous waste in particular. Recycling should be considered and implemented at every practicable stage of the project.

5.2 WASTE DISPOSAL

A. Pollution Prevention: The contractor should use prior planning to find those materials and work practices that will minimize the creation of waste in general and hazardous waste in particular.

B. Hazardous Waste Generation, Handling, and Disposal. Work done under this contract is to be performed on a government facility. According to rules and procedures of the United States Environmental Protection Agency, the federal facility is required to have a generator identification number under the Resource Conservation and Recovery Act (RCRA) and to be responsible for wastes (as defined under RCRA) produced, managed, stored, disposed on, or transported from the facility. Accordingly, Contractor will, to the greatest extent practicable, use materials, processes, and techniques that will avoid the creation of hazardous waste. Contractor shall prepare and follow a written waste management and disposal plan for all hazardous wastes generated on the site. Prior to generation of any hazardous wastes, contractor will coordinate planned activities regarding hazardous materials and hazardous waste with the Contracting Officer. Contractor shall submit a written waste management plan, through the contracting officer, to installation environmental office. Contractor shall follow this plan once it has been approved by the contracting officer. Under no circumstances will contractor bring onto the site hazardous waste that has been generated elsewhere. All hazardous waste will be properly disposed of by the Contractor in accordance with all federal, state, and local requirements.

C. Disposal of Non-RCRA Wastes. All non-hazardous wastes generated on the site as a result of this contract must be disposed of properly, in accordance with all federal, state and local requirements. Materials will be recycled whenever practicable. Prior to creation of such wastes, the contractor shall submit to the installation environmental management function, through the Contracting Officer, a plan for disposal of wastes. Such plan shall include the types of waste to be created, how they shall be stored, managed and disposed. Contractor shall follow this plan once it has been approved by the installation and contracting officer. Such wastes will not be created until approved by the Contracting Officer.

D. Construction Debris.

1. Debris from demolition of existing structures will ordinarily be removed to a location on the installation, as designated by the installation authorities.

2. If a location on the installation is not available, other sections in this contract may require the contractor to remove clean construction debris from the site to a location of the contractor’s choosing off the installation. (Site soil or other site media are not covered by this paragraph.) Debris will be recycled or disposed of in accordance with all applicable federal, state and local rules. Such debris must be free of all contamination, including but not limited to, lead paint, asbestos, and insecticides. Prior to removal of any construction debris, that debris must be certified by the installation to be free of contamination and of no value to the United States, and this certification must be provided to the contracting officer. To expedite work, this may be accomplished by a teletypewriter or other suitable electronic means, however, the original certification form must be provided to the contracting officer. No form is prescribed for this certification so long as all necessary information is provided and the document is signed by an authorized installation
representative. However, an example is provided at page 7 and this form may be used. All construction debris removed from the installation must be covered by a certification. The contractor must arrange with the installation POC whether all debris will be covered by one certification or if several certifications will be required.

E. Consolidated Waste Disposal Plans: Contractor may, at contractor’s option, submit for approval as specified above one consolidated plan for handling hazardous and non-hazardous wastes.

F. Earthwork and Removal of Potentially Contaminated Media:

1. Unless otherwise specified elsewhere in this contract, the site has been inspected and is, consistent with best professional judgment, free of environmental contamination or pollution. However, work under this contract will be performed on a military installation, where the history of prior military and industrial activities is not necessarily completely known. The following provisions prohibit the removal from the installation of soil or other materials found on site and are included, in an abundance of caution, for the protection of EXCHANGE, the installation, and the contractor.

2. Notwithstanding any other clause in this contract, including but not limited to all standard site work general provisions (02010-02900); no media by-product resulting from site preparation, construction or excavation shall be moved off the post, base, or installation where the construction is occurring. If the construction is off the post, base or installation, no media by-product shall be moved off the construction site.

3. The contractor shall: (1) leave the media in place at the site, subject to appropriate erosion control; or (2) haul the media to and place it at a location on the installation that has been designated either in this contract or in writing by the contracting officer; and (3) if unforeseen difficulties arise, such as excessive quantity of media is generated, the contractor shall advise the contracting officer and shall not remove media from the site without written authorization from the contracting officer.

DEFINITIONS

Media - Any soil, water, or air, moved, disturbed or released from a site.

The terms hazardous, waste, pollutant, contaminate, substance have the same meanings and usage here as they commonly do in CERCLA, RCRA, FWPCA, CAA, TSCA, and SDWA respectively.”
INSTALLATION CERTIFICATION FOR CLEAN CONSTRUCTION DEBRIS TO BE REMOVED FROM EXCHANGE PROJECT SITE

As representative of ________________________ (insert name of installation), I am authorized to certify, and hereby do so certify, that the construction debris to be removed from the EXCHANGE project site at ________________________ (describe project and list address, for example Main Exchange Project, 111 Road A, X installation) has been inspected and is of no value to the United States and is free of all contamination, including but not limited to: lead paint, asbestos, PCBs, and pesticides.

CERTIFICATION:

Signed: ___________________________________________  Date: ________________

Printed Name, Rank or Grade, and Duty Title:

_____________________________________________

ORIGINAL OF THIS FORM MUST BE PROVIDED TO CONTRACTING OFFICER
PART 6 - UNEXPECTED SITE CONDITIONS

6.1 CONTAMINATED SOIL OR GROUNDWATER.
Unless otherwise specified elsewhere in this contract, site has been inspected and is, consistent with best professional judgment, free of environmental contamination or pollution. However, unexpected conditions can always arise. Contractor or subcontractor personnel may encounter soil or groundwater that is suspected to be contaminated, either because of odors, colors, free liquids, unexpected construction debris, or other suspicious conditions. Should this occur, contractor will immediately notify the Contracting Officer and the installation environmental office and take necessary initial measures to protect workers, the site, and other personnel.

6.2 UNEXPECTED ARTIFACTS OR RELICS
Should contractor employees in the course of site preparation or other work on this contract find unexpected historic or archeological remains, such as bones, arrow points, pottery remnants, foundations, or other evidence of previous uses of the site, contractor will cease further site-disturbing activity and immediately notify the Contracting Officer and installation environmental office.

END OF SECTION 013543
SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. The Contractor shall establish a quality control system to perform sufficient inspection and tests of all items of work, including that of his subcontractor(s) to insure conformation to applicable specifications and drawings with respect to the materials, workmanship, construction, finish and functional performance. Tests of materials and/or special inspections will be made, when required by these specifications, by applicable law, rules and regulations in accordance with respective Sections of the specifications. Where required, the Contractor shall employ and pay for the services of an independent agency to perform specific services and testing. Examples of such services are tests of fill materials, concrete materials, concrete mix design, asphalt concrete laboratory testing of materials proposed and calculations for asphalt concrete mixtures, etc.

B. The Contractor shall arrange and pay for all services and testing which are not specifically indicated to be provided by EXCHANGE.

C. If a material is not required to be field tested, the Contracting Officer may require the supplier to furnish with each delivery of such material, a certificate bearing legal signature of said supplier, stating that such material complies with specification requirements.

D. If any work or material requiring tests and inspections is executed, enclosed or covered before tests are made, or test reports distributed, then the Contractor shall, at his own expense, uncover such part of this work or material and keep it uncovered until such tests and inspections have been made and test reports distributed. If work or material so tested and inspected shall not be found to conform to the requirements of the Construction Documents, it shall be deemed and construed to be defective materials or faulty workmanship and the Contractor, at his own expense, shall replace work or material removed and repair all work disturbed thereby.

1.2 EXCHANGE RESPONSIBILITY

A. EXCHANGE will employ and pay for the services of an Independent Testing Agency to perform specified quality control testing during construction indicated in the following sections:

8. Cast-in-Place Concrete: Section 03 30 00.
9. High Strength Bolted Connections: Section 05 12 00.
10. Field Welding: Section 05 12 00.
11. Testing Adjusting and Balancing for HVAC: Section 23 05 93.
1.3 CONTRACTORS RESPONSIBILITY

A. Cooperate with the Contracting Officer and laboratory personnel and provide access to work an to manufacturer’s operations. Provide samples of materials to be tested, in required quantities. Furnish casual labor and facilities required to provide access to work to be tested; to obtain and handle samples at the site; to facilitate inspections and tests; and for laboratory’s exclusive use for storage and curing of test samples. Notify laboratory sufficiently in advance of operations to allow for its assignment of personnel and scheduling of tests.

B. The use of EXCHANGE’ or Contractor’s independent testing services shall in no way relieve the Contractor of his responsibility to furnish materials and construction in full compliance with the plans and specifications.

C. The Contractor shall coordinate with both EXCHANGE and his own testing laboratories so that the work will be inspected and tested according to contract requirements. This coordinately includes notification of when tests should be taken, easy access to the work, and general cooperation in every way to insure proper control of the work.

D. Upon completion of the project the Contractor shall submit a signed certificate stating tests for this work were made in accordance with provisions of these specifications and, further, all such tests and reports made were reported as required. This certificate shall list all tests and dates when work was completed.

1.4 AGENCY RESPONSIBILITIES

A. Test samples of mixes submitted by Contractor.

B. Provide qualified personnel at site. Cooperate with Contracting Officer and Contractor in performance of services.

C. Perform specified sampling and testing of Products in accordance with specified standards.

D. Ascertian compliance of materials and mixes with requirements of Contract Documents.

E. Promptly notify Contracting Officer, and Contractor of observed irregularities or non-conformance of Work or Products.

F. Perform additional tests required by Contracting Officer.

G. Provide Contracting Officer with three (3) copies of each written test report, and the Contractor each with one copy of each test report. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing Laboratory name, address and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature.
7. Date of test.
8. Identification of product and specification section.
9. Location of sample or test in the project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by the Contracting Officer.
H. Upon completion of the project, the testing agency shall prepare a certificate, certified in the presence of a Notary Public, stating testing for this work was conducted in accordance with the provisions of these specifications, and further, all tests and reports were provided for this job were reported as required.

1.5 LIMITS ON TESTING AUTHORITY

A. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Agency or laboratory may not approve or accept any portion of the Work.

C. Agency or laboratory may not assume any duties of Contractor.

D. Agency or laboratory has no authority to stop the Work.

1.6 RELATED REQUIREMENTS

A. Required Submittals Section 01 33 00.

B. Related requirements and tests specified in Division 2 through 33.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 40 00
SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

   B. Related Requirements:
      1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES
   A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

   B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

   C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

   D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

   E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

   F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS
   A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

   B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

      1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
      2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
5. Other dust-control measures.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

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

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
3. Drinking water and private toilet.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. 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: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Coordinate sanitary sewer connection size and location(s) with Scott AFB DPW.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

J. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead or underground unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

L. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:
   a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Contractor's emergency after-hours telephone number.
   e. Architect's office.
   f. Engineers' offices.
   g. Owner's office.
   h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
3. Support facility shall be placed on existing paved surfaces. Final location to be approved by Scott AFB DPW and Scott AFB Fire Marshal.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary or use designated areas of Owner's existing parking areas, if available and approved by the Exchange for construction personnel.

D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

E. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."


3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
D. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

H. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner and tenants from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.

2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.

4. Insulate partitions to control noise transmission to occupied areas.

5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.

6. Protect air-handling equipment.

7. Provide walk-off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
3.5  MOISTURE AND MOLD CONTROL


B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
   a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
   b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
   c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6  OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been 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 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 Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 01 50 00
SECTION 01 51 00

TEMPORARY UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities: Electricity, lighting, heat, ventilation, telephone service, water and sanitary facilities.

1.2 RELATED SECTIONS

A. Section 01 59 00 - Field Offices and Sheds.
B. Section 01 77 00 - Project Closeout.

1.3 TEMPORARY ELECTRIC

A. The contractor shall furnish and install a complete, temporary electric service for construction needs throughout the construction period.

1. The temporary electric service shall originate from within the existing building. The electrical contractor shall be responsible for furnishing and installing all fused cutouts, conductors, disconnects, and miscellaneous hardware.

2. The temporary electric service shall be a 120/208 volt, 3 phase, 4 wire, 200 amp service for construction operations.

3. Provide power centers, located such that all points of the construction area can be reached with extension cords no more than 100 feet long. Provide 20 amp, 120 and 208 volt grounded outlets, for use by all trades, each protected by a circuit breaker.

4. The Contractor will not be charged for a reasonable amount of electricity consumed. The contractor shall maintain strict conservation measures to prevent wasteful use of electricity.

5. Use of electric resistance heating devices is not permitted.

6. Unusually heavy electric loads, such as electric welding equipment, and other equipment with special power requirements shall not be connected to the existing system.

B. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of five (5) foot candles.

1. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

2. Provide guarded lighting sockets and lamps. Use 100 watt lamps, minimum. Maintain 110 volts in lighting system.

3. Maintain lighting and provide routine repairs.

4. Permanent building lighting may be utilized during final stages of construction.

C. Field Offices and Sheds: Provide electric service to the field office(s) and shed(s) to meet the requirements listed in Section 01 59 00 - Field Offices and Sheds.

D. Standards: the temporary electric service shall comply with the National Electric Code. Extension cords used by any and all trades, shall be UL approved. No temporary power is to come from the building.
1.4 TEMPORARY HEATING

A. General: The Contractor shall provide, install and maintain temporary heat in the construction areas throughout the construction period to facilitate the progress of work, protect work against cold, dampness, condensation, and to provide suitable ambient temperatures and humidity levels for proper installation and curing of materials.

B. Requirements: The Contractor shall provide and maintain temporary heat meeting the following requirements:

1. As required under each individual specification section for proper placement, setting, and curling of materials.
2. Maintain a minimum temperature of 40 degrees F. For twenty four (24) hours a day during placing, setting, and curing of cementations materials.
3. Maintain a minimum temperature of 50 degrees F., or as required under each individual specification section, for twenty four (24) hours a day, seven (7) days prior to, and during installation of all finish materials, including but not limited to: resilient flooring and base, carpet, paint and wall covering, tile work, acoustic ceilings, and all finish woodwork.
4. Maintain a minimum temperature of 65 degrees F. For twenty four (24) hours a day from the time of placement until beneficial occupancy, for installation all finish materials, including but not limited to: resilient flooring and base, carpet, paint and wall covering, tile work, acoustic ceilings and all finish woodwork.

C. The Contractor may use the existing permanent heating system for temporary heat during construction, supplemented by temporary equipment if needed, under the following conditions:

1. Use of the existing permanent equipment does not spread hazardous or objectionable dust, fumes, mists, vapors, gases or odors into areas occupied by EXCHANGE or other Personnel or customers.
2. Use of the existing permanent equipment does not damage or cause excessive wear to the equipment.
3. The Contractor shall provide and pay for operation, maintenance, and replacement of filters and worn or damaged parts on the equipment used.

D. The Contractor will not be charged for a reasonable amount of fuel or energy used by the existing permanent equipment. The Contractor shall maintain strict conservation measures to prevent waste of fuel or energy.

E. The Contractor shall pay for the fuel consumed by temporary heating devices.

F. Temporary equipment using electric resistance heating is not permitted.

1.6 TEMPORARY COOLING

A. The Contractor may utilize the existing cooling system, extend and supplement with temporary cooling devices as needed to maintain specified conditions for construction operations.

B. The Contractor will not be charged for a reasonable amount of fuel or energy consumed by the existing system. The Contractor shall maintain strict conservation measures to prevent waste of fuel or energy.
1.7 TEMPORARY VENTILATION

A. The Contractor shall provide adequate ventilation to:

1. Aid in curing installed materials.
2. Dispersal of humidity.
4. Prevent hazardous accumulations of dust, fumes, mists, vapors, or gases in areas occupied during construction.

B. The Contractor may use the existing, permanent ventilating equipment, supplemented by temporary equipment, if required, under the following conditions:

1. Use of the existing, permanent equipment does not spread hazardous or objectionable dust, fumes, mists, vapors, gases, or odors into areas of the building occupied by EXCHANGE personnel or customers.
2. Use of the existing, permanent equipment does not cause damage to equipment.
3. The Contractor shall provide and pay for operation, maintenance, and replacement of filters and worn or damaged parts on the equipment used.

1.8 TELEPHONE SERVICE

A. Provide, maintain, and pay for telephone service to field office at time of project mobilization.

B. Refer to Section 01 59 00 - Field Offices and Sheds.

1.9 TEMPORARY WATER SERVICE

A. Connect to existing water source for construction operations at time of project mobilization.

B. The Contractor will not be charged for a reasonable amount of water consumed for construction purposes. The Contractor shall maintain strict conservation measures to prevent waste of water.

C. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide at time of project mobilization.

B. Furnish, install, and maintain adequate portable chemical toilets for use by construction personnel.

C. Provide regular maintenance service to maintain clean and sanitary conditions.

PART 2 PRODUCTS (NOT USED)
PART 3 EXECUTION

3.1 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

B. Temporary Barriers: Provide floor-to-ceiling dustproof barriers to limit dust and dirt migration and to separate areas occupied by EXCHANGE and tenants from fumes and noise.

1. Dust Barrier: Where dust barriers are required, provide a single layer of 6 mil fire resistant clear polyethylene fiberglass reinforced sheet as manufactured by Griffolyn, or equal. Tape all joints and provide fire resistant treated 2 x 4 wood or metal stud top and bottom runners and verticals 4 foot o.c. with polyethylene sheet wrapped and taped to the runners.

2. Opaque Dust Barrier: Where dust barriers are required and where indicated for long duration separation of construction operations from EXCHANGE and tenant spaces, provide braced metal stud framing covered on construction side with 6 mil fire resistant clear polyethylene fiberglass reinforced sheet as manufactured by Griffolyn, or equal. Tape all joints and perimeter. Provide ½ inch gypsum board, fire taped on the EXCHANGE/tenant side from floor to ceiling. Provide R-11 batt insulation for thermal separation from unconditioned construction areas and noise reduction adjacent to sales, food service or office areas.

3. Security Weather-tight Barrier: Where a secure weather-tight barrier is required and where a temporary exit enclosure through surrounding and overhead construction is indicated, provide braced metal stud framing covered on construction side with ½ inch plywood. Provide ½ inch gypsum board, fire-taped on the EXCHANGE/public side on entire enclosure. Provide R-11 batt insulation for thermal separation from the exterior, unconditioned construction areas and noise reduction adjacent to sales, food service or office areas. Panelize framing for ease of removal and relocation.

   a. Construct vestibule at each access through the barrier with 1-3/4 inch solid core wood doors with ¾” wood frames spaced not less than 6 feet apart. Doors shall be hinged with latches and provided with double high security padlocks in accordance with EXCHANGE security. Maintain water dampened or adhesive surfaced foot mats in vestibules.

   b. At temporary exits, provide individual 1-3/4 inch solid core wood doors with ¾ inch wood frames at each end of the enclosure swinging in the direction of exit. Provide hinges, exit devices and closers. Exit devices to always be operable in the direction of exiting and locked on the opposite side.

C. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

END OF SECTION 01 51 00
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Temporary field offices and sheds.
B. Maintenance and cleaning.
C. Removal.

1.2 RELATED SECTIONS

A. Section 01 10 00 - Summary.
B. Section 01 50 10 - Temporary Utilities.

PART 2 - PRODUCTS

2.1 MATERIALS, EQUIPMENT, FURNISHINGS

A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

2.2 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
B. Construction: Structurally sound, secure, weather tight enclosures for office and storage spaces. Maintain during progress of Work; remove at completion of Work.
C. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with occupancy and storage requirements.
D. Exterior Materials: Weather resistant, finished in one color acceptable to Contracting Officer.
E. Interior Materials in Offices: Sheet type materials for walls and ceilings, pre-finished or painted; resilient floors and bases.
F. Lighting for Offices: 50 ft-C (538 lx) at desk top height, exterior lighting at entrance doors.
G. Fire Extinguishers: One 10# standard dry chemical (ABC) type fire extinguisher at each office and each storage area.
H. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.
2.3 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating for Offices: Automatic equipment to maintain 68 degrees F (20 degrees C) heating and 76 degrees F (23 degrees C) cooling.

B. Storage Spaces: Heating and ventilation as needed to maintain Products in accordance with Contract Documents; adequate lighting for maintenance and inspection of Products.

2.4 CONTRACTOR OFFICE AND FACILITIES

A. Size: For Contractor's needs and to provide space for project meetings. Minimum size: 150 square feet.

B. Telephone: The Contractor shall install, maintain and pay for telephone service for the Contractor's field office including an answering device and outside bell.

C. Internet, E-Mail and Fax: Install, maintain and pay for services for the Contractor's Field Office.

D. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

E. Other Furnishings: Contractor's option.

F. Equipment: Six (6) adjustable band protective helmets for visitors, one 10 inch (250 mm) outdoor weather thermometer and a weather protected bulletin board for posting information required by the contract.

2.5 CONTRACTING OFFICER'S FIELD OFFICE

A. Separate space for sole use by the EXCHANGE Contracting Officer, with separate entrance door with new lock and two keys.

B. Area: Minimum 150 sq ft (14 sq m), minimum dimension 8 ft (2.4 m).

C. Windows: Minimum three minimum total area of 10 percent of floor area, with operable sash and insect screens. Locate to provide views of construction area.

D. Electrical Distribution Panel: Two circuits minimum, 110 volt, single phase service.

E. Minimum four 110 volt duplex convenience outlets, one on each wall.

F. Telephone: The Contractor shall install, maintain and pay for telephone service to the Contracting Officer's field office, including an answering device. The Contractor shall pay for basic service and local calls only, but will not pay for long distance calls.

G. Furnishings:

1. One desk 54 x 30 inch (1.4 x 0.75 m), with three drawers.
2. One drafting table 36 x 72 inch (one x 1.8 m), with one equipment drawer.
3. Plan rack to hold working Drawings, shop drawings, and record documents.
4. One standard four-drawer legal size metal filing cabinet with locks and two keys per lock.
5. Six linear ft (2 m) of metal bookshelves.
6. Two swivel arm chairs.
7. Two straight chairs.
8. One drafting table stool.
9. One tackboard 36 x 30 inch (1 x 0.75 m).
10. One waste basket per desk and table.

2.6 STORAGE AREAS AND SHEDS

A. Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products.

PART 3 - EXECUTION

3.1 PREPARATION

A. Fill and grade sites for temporary structures to provide drainage away from buildings.

3.2 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date of Notice to Proceed.

B. Employee Residential Occupancy: Not permitted on Installation property.

3.3 MAINTENANCE AND CLEANING

A. Weekly cleaning services for offices; periodic cleaning and maintenance for office and storage areas.

B. Maintain approach walks free of mud, water, and snow.

3.4 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION 01 59 00
SECTION 01 71 00
CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Progress Cleaning.
B. Final Cleaning.

1.2 RELATED SECTIONS

A. General Provisions of the Contract.
B. Section 01 10 00 - Summary.
C. Section 01 14 50 - Cutting and Patching.
D. Section 01 50 00 – Temporary Facilities and Controls.
E. Individual Specification Sections - Cleaning Requirements.

1.3 SAFETY REQUIREMENTS

A. Standards: Maintain project in accordance with the following safety and insurance standards:

B. O.S.H.A. Standards:
   1. The Contractor shall be required to comply with OSHA Requirements in 29 CFR 1926 and 29 CFR in 1910. The OSHA Standards are subject to change, and such changes may affect the Contractor in his performance under the contract. It is the Contractor's responsibility to know such changes, effective dates of changes, and comply with all requirements.

C. Hazards Control:
   1. Store volatile wastes in covered metal containers and remove from premises daily.
   2. Prevent accumulation of wastes which create hazardous conditions.
   3. Provide adequate ventilation during the use of volatile or noxious substances.

D. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish and waste materials on the installation.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Use only cleaning materials recommended by the manufacturer of the surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. Execute cleaning to ensure that the building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

B. Maintain site in a clean and orderly condition.

C. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

D. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off of Government property.

E. Vacuum clean interior building areas when ready to receive finish painting, and continue cleaning to eliminate dust.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights. Open free-fall chutes are not permitted.

G. Schedule cleaning operations so that dust and other contaminants resulting from the cleaning process will not fall on wet, newly painted surfaces.

3.2 FINAL CLEANING

A. Employ professional cleaners for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces and of concealed spaces.

C. Remove grease, dust, dirt, stains, temporary labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine; finish vacuum carpeted and soft surfaces.

D. Repair, patch, and touch-up marred surfaces to specified finish, to match adjacent surfaces.

E. Clean all glass.

F. Replace all HVAC filters within the construction area with filters to match existing.

G. Clean ducts, blowers, and coils, if air HVAC units were operated without filters during construction.

H. Maintain cleaning until project, or portion thereof, is occupied by EXCHANGE.

END OF SECTION 01 71 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
1. Division 02 Section “Selective Demolition” for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Demolition Waste:
   a. Concrete.
   b. Concrete reinforcing steel.
   c. Concrete masonry units.
   d. Wood studs.
   e. Plywood and oriented strand board.
f. Wood paneling.
g. Wood trim.
h. Structural and miscellaneous steel.
i. Rough hardware.
j. Insulation.
k. Doors and frames.
l. Door hardware.
m. Windows.

n. Glazing.
o. Metal studs.
p. Gypsum board.
q. Acoustical tile and panels.
r. Carpet.
s. Carpet pad.
t. Demountable partitions.
u. Equipment.
v. Cabinets.
w. Piping.
x. Supports and hangers.
y. Valves.
z. Sprinklers.
aa. Electrical conduit.
bb. Copper wiring.
c. Lighting fixtures.
dd. Lamps.
ee. Ballasts.
ff. Electrical devices.
gg. Switchgear and panelboards.

hh. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Insulation.
g. Carpet and pad.
h. Gypsum board.
i. Piping.
j. Electrical conduit.
k. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
7) Plastic pails.
1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

A. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

B. Waste Management in Historic Zones or Areas: Hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches (300 mm) or more.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Lighting Fixtures: Separate lamps by type and protect from breakage.

G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

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

3.4 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
   1. Pulverize concrete to maximum 4-inch (100-mm) size.

B. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Pulverize masonry to maximum 1-inch (25-mm) size.
   2. Clean and stack undamaged, whole masonry units on wood pallets.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

G. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

H. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

I. Carpet Tile: Remove debris, trash, and adhesive.
   1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

J. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

K. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

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

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
   1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

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

B. Burning: Do not burn waste materials.

C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

D. Disposal: Remove waste materials from Owner's property and legally dispose of them.
SECTION 01 77 00

PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Substantial Completion.
B. Final Inspections.
C. Closeout Submittals.
   1. Operation and Maintenance Manuals.
   2. Operation and Maintenance Instruction.

1.2 RELATED SECTIONS:

A. General Provisions of the Contract: Final Acceptance and Payment.
B. Section 01 33 00 – Submittal Procedures.
C. Section 01 71 00 - Cleaning.
E. Section 01 78 39 - Project Record Documents.

1.3 SUBSTANTIAL COMPLETION:

A. Preliminary Procedures: Before requesting inspection, complete the following.
   1. Contractor's list of incomplete items (punch list) prepared.
      a. Submit PDF electronic file.
      b. Submit paper copies.
   2. Owner advised of pending insurance changeover.
   3. Warranties, maintenance service agreements, and similar documents submitted.
   4. Releases, occupancy permits, and operating certificates submitted.
   5. Project Record Documents submitted.
   6. Tools, spare parts, and extra materials delivered.
   7. Final changeover of locks performed.
   8. Temporary facilities removed.
  11. Owner's personnel instructed in operation, adjustment, and maintenance of equipment and systems, including demonstration and training videotapes submitted.
B. Contractor:
   1. Submit written certification to Contracting Officer that project, or designated portion of Project, is substantially complete.
   2. Submit list of major items to be completed or corrected.

C. Contracting Officer will make an inspection after receipt of certification.

D. Should Contracting Officer consider that work is substantially complete:
   1. Contractor shall prepare, and submit to Contracting Officer, a list of items to be completed or corrected, as determined by the inspection.
   2. Contracting Officer will prepare and issue a Certificate of Substantial Completion, containing:
      a. Date of Substantial Completion.
      b. Contractor's list of items to be completed or corrected, verified, and amended by Contracting Officer.
      c. The time within which Contractor shall complete or correct work of listed items.
      d. Time and date EXCHANGE will assume possession of work or designated portion thereof.
      e. Responsibilities of EXCHANGE and Contractor for:
         (1) Utilities.
         (2) Operation of mechanical, electrical, and other systems.
         (3) Maintenance and cleaning.
         (4) Security.
      f. Signatures of:
         (1) Contracting Officer.
         (2) Contractor.
   3. EXCHANGE occupancy of project or designated portion of project:
      a. Contractor shall:
         (1) Perform final cleaning in accordance with Section 01 71 00.
      b. EXCHANGE will occupy project, under provisions stated in Certificate of Substantial Completion.

4. Contractor: Complete work listed for completion or correction, within designated time.

E. Should Contracting Officer consider that work is not substantially complete:
   1. He shall immediately notify Contractor, in writing, stating reasons.
   2. Contractor: Complete work, and send second written notice to contracting officer, certifying that project, or designated portion of project, is substantially complete.
   3. Contracting Officer will reinspect work.

1.4 FINAL INSPECTION

A. Contractor shall submit written certification that:
   1. Contract documents have been reviewed.
   2. Project has been inspected for compliance with contract documents.
   3. Work has been completed in accordance with Contract Documents.
4. Equipment and systems have been tested in presence of Facility Representatives and are operational.
5. Project is completed and ready for final inspection.

B. Contracting Officer will make final inspection after receipt of certification.

C. Should the Contracting Officer consider that work is finally complete in accordance with requirements of contract documents, he shall request contractor to make project closeout submittals.

D. Should the Contracting Officer consider that work is not finally complete:
   1. He shall notify contractor, in writing, stating reasons.
   2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to the Contracting Officer certifying that work is complete.
   3. The Contracting Officer will reinspect work.

1.5 PROJECT RECORD DOCUMENTS:

A. Project Record Documents: Specified requirements of Section 01 78 39.

1.6 OPERATION AND MAINTENANCE MANUALS:

A. Submit data bound in 8-1/2 x 11 inch text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "Operation and Maintenance Manuals", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on 20 pound white paper, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Value chart.
      f. Maintenance instructions for equipment and systems.
      g. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties.
      e. Training Sessions attendance roster.
f. Warrantees.

E. Submit six (6) copies of the operation and maintenance manuals to the Contracting Officer.

1.7 OPERATION AND MAINTENANCE INSTRUCTION:

A. The Contractor shall provide, at his expense, manufacturer's representatives to completely check out all mechanical and electrical systems and items covered by the drawings and specifications. This requirement shall be scheduled just prior to, and during the initial start up. After all systems are functioning properly, the representatives shall instruct Facility Maintenance Personnel in the proper operation and maintenance of each item. In addition to instructions given at the project, the Facility Maintenance Personnel shall be given a classroom instruction course on operation and maintenance of the systems. Training sessions shall be limited to four (4) continuous hours where practical. Schedule additional four (4) hour sessions as required.

1.8 DD FORM 1354:

A. Preparation of DD Form 1354 "Transfer and Acceptance of Military Real Property": At the conclusion of the project the Contractor will compile and furnish to the Contracting Officer certain costs and quantity data of materials and systems furnished and installed. A list of items for which the costs and quantity data are required will be furnished to the Contractor. Such information will be returned to the Contracting Officer within 10 days from the receipt of the list. Form is attached at the end of Division 1.

1.9 WARRANTY AND EXTENDED WARRANTIES:

A. Upon completion of project, prior to final payment, guarantees required by technical divisions of Specifications shall be properly executed in quadruplicate by subcontractors and submitted to Contracting Officer. Delivery of guarantees shall not relieve contractor from any obligation assumed under contract.

B. Submit guarantee covering entire project for one year. In addition, where separate guarantees, for certain portions of work, are for longer periods, General Contractor’s guarantee shall be extended to cover such longer periods.

C. Guarantees shall become valid and operative upon issuance of Certificate of Inspection and Acceptance by EXCHANGE. Guarantees shall not apply to work where damage is a result of abuse, neglect by EXCHANGE, or his successor(s) in interest.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 77 00
SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Submittals: Section 01 33 00 – Submittal Procedures.

1.2 RECORD FIELD DATA

A. General: Maintain at job site, two complete sets of Contract Documents. During construction, both sets shall be marked to show all deviations in actual construction from the Contract Documents.

1. Red Markers: Indicate all additions.
2. Green Markers: Indicate all deletions.

B. Record Documents: The drawings shall show, but no be limited to, the following information:

1. Locations and description of any utility lines and other installations of any kind or description known to exist within the construction area. Include dimensions and/or survey coordinates to permanent features.
2. Locations and dimensions of any changes within the building or structure and the accurate location and dimension of all underground utilities and facilities.
3. Changes in details of design or additional information obtained from shop drawings prepared or furnished by the Contractor including, but not limited to:
   a. Fabrication erection
   b. Installation and placing details
   c. Pipe sizes
   d. Insulation materials
   e. Equipment pad dimensions
4. All changes or modifications from the original design.
5. Where contract drawings or specifications allow options, only the option actually used in the construction shall be shown on the Record Drawings. The option not used shall be deleted.

C. Record Field Data: All deviations shall be shown in the same general detail utilized in the Contract Documents. Marking of the documents shall continue throughout construction to keep the documents up to date.

1. Additional Data: The Contractor shall maintain the following:
   a. Full size marked-up drawings.
   b. Survey notes
   c. Sketches
   d. Nameplate data
   e. Pricing information
   f. Description and serial number of all equipment

2. Record field data shall be available for inspection by the Contracting Officer whenever requested and shall be jointly inspected for accuracy and completeness by the Contracting Officer and
Contractor. Failure to keep record field data current shall be sufficient justification to withhold a retained percentage from the monthly Application for Payment.

D. Submittal of Record Field Data:

   1. Submit two sets to the Contracting Officer a minimum of 20 calendar days prior to the date of final inspection.
   2. The Contractor shall make all corrections identified during Contractor Officer review and resubmit corrected data within ten (10) calendar days of receipt.
   3. When data is accepted as complete, one set of documents will be returned to the Contractor for completion of the Record Documents.

1.3 RECORD ELECTRONIC FILE DOCUMENTS

A. Electronic File Format: No earlier than 30 days after award, the Contracting Officer will provide one set of AutoCAD electronic file format contract drawings to be used for preparation of Record Drawings.

   1. Media: ISO – 9660 CD
   2. The Contractor shall verify usability of AutoCAD files and notify the Contracting Officer of any discrepancies within 30 calendar days of receipt. Any discrepancies will be corrected and files returned to the Contractor.
   3. The Contractor shall incorporate all deviations from the original Contract Documents as recorded in the approved “Record Field Data” as indicated in Paragraph 1.2.C above.
   4. The Contractor shall also incorporate all written modifications to the Contract Documents which were issued by amendment or contract modification.
   5. All revisions and changes shall be incorporated:

      a. Items marked deleted shall be deleted.
      b. Clouds around new items shall be removed.

B. Electronic File Submittal: Submit a complete set of Record Drawings in AutoCAD electronic file format no later than 30 days after final acceptance. The Record Drawings shall be done in equal quality to the originals, including line work, line weights, lettering and symbols. Identify each drawing with the word “RECORD” in block letters at least 3/8” high above the title block. The date of completion and the words “Revised Record” shall be placed in the revision block above the latest revision notation.

   1. Format: AutoCAD Release 2005 ‘DWG’ format. All support files required to display or plot the files in the same manner as they were developed shall be delivered along with the files, including but not limited to:

      a. Font files
      b. Menu files
      c. Plotter setup
      d. Referenced files
2. Layering: Conform to AIA Standard Document, “CAD Layer Guidelines,” latest version. An explanatory list of which layer is used at which drawing and an explanatory list of all layers which do not conform to the standard AIA CAD Layer Guidelines including any user definable fields permitted by the guidelines shall be provided with each submittal.

3. Electronic File Deliverable Media: ISO 9660 Format CD-ROM. Submit three (3) complete sets of disks and one complete set of full size reproducible prints taken from the disks. Each disk shall have a clearly marked label stating the Contractor’s firm name, project name and location, submittal type (record) and date. Each submittal shall be accompanied by a hard copy transmittal sheet that contains the above information along with tabulated information about each file as shown below:

<table>
<thead>
<tr>
<th>Electronic File Name</th>
<th>Plate Number</th>
<th>Drawing Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Include electronic version of the table.</td>
<td></td>
</tr>
</tbody>
</table>

4. Submit one copy of the CD-Rom and one set of full-size Mylar reproducibles of the drawings to (Building Records staff person) at (Post or Base).

1.4 SUBMITTAL OF FINAL RECORD DRAWINGS

A. Complete and return the final record documents and the approved preliminary record documents to the Contracting Officer within 30 calendar days of final acceptance.

1. All drawings from the original contract documents shall be included, including drawings where no changes were made.
2. The drawings will be returned to the Contractor if corrections are necessary.
3. The Contractor shall make all corrections and shall return the drawings to the Contracting Officer within seven (7) calendar days of receipt.

1.5 RECORD DOCUMENT COST

A. All costs incurred by the Contractor in the proportion and furnishing of record documents, including electronic file format, shall be included in the contract price and no separate payment will be made for this work.

1. Approval and acceptance of the final record documents shall be accomplished before final payment is made to the Contractor.

1.6 SYSTEM ACCEPTANCE TESTING

A. Provide one set of marked-up record drawings at the time of system acceptance testing. These record drawings shall be in addition to the submittal of marked-up record drawings specified elsewhere in the contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 017839
PART 1 - GENERAL

1.2 SUMMARY

A. This Section includes the following:
   1. Removal of selected interior finishes in areas to be modernized.
   2. Patching and repairs.
   3. Salvage existing items to be reused or recycled.

B. Work by Others: Elements of selective demolition will be accomplished by EXCHANGE or the Air Force under separate contracts:
   1. Retail display fixture removal/relocation.

C. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Summary" for use of the building and phasing requirements.
   2. Division 1 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures for selective demolition operations.
   3. Division 21 Sections for cutting, patching, or relocating Fire Sprinkler items.
   4. Division 26 Sections for cutting, patching, or relocating Electrical items.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain EXCHANGE property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain EXCHANGE property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to EXCHANGE' designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Contracting Officer, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain EXCHANGE property, demolished materials shall become the Contractor's property and shall be removed from the site and legal disposed of off Installation.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.
B. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of EXCHANGE' on-site operations.
5. Coordination of EXCHANGE' continuing occupancy of portions of existing building and of EXCHANGE' partial occupancy of completed Work.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

D. Record drawings at Project close-out according to Division 1 Section "Project Closeout."

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.6 PROJECT CONDITIONS

A. EXCHANGE will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that EXCHANGE' operations will not be disrupted. Provide not less than 72 hours' notice to EXCHANGE of activities that will affect EXCHANGE' operations.

B. EXCHANGE assumes no responsibility for actual condition of buildings to be selectively demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by EXCHANGE as far as practical.

C. Hazardous Materials: Asbestos and lead paint are present in areas of demolition. Demolition (monitoring), removal and disposal must comply with all state and federal codes and requirements of the specifications.

D. Where existing opening infills in the retail sales area are scheduled for demolition, maintain interior wall furring and finishes.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

C. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Contracting Officer.

D. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by EXCHANGE and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to EXCHANGE and to governing authorities.

   a. Provide not less than 72 hours' notice to EXCHANGE if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

   1. Arrange to shut off indicated utilities with utility companies.
   2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

C. Utility Requirements: Refer to Divisions 21, and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

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

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from EXCHANGE and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

   1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.
5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.
6. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4-inch (100-mm) studs, 5/8-inch (16-mm) gypsum wallboard with joints taped on occupied side, and 1/2-inch (13-mm) fire-retardant plywood on the demolition side.
2. Insulate partition to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weatherstrip openings.

E. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

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

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

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

1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

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

3.5 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before
starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

4. Maintain adequate ventilation when using cutting torches.

5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

7. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

8. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.

9. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Break up and remove concrete slabs on grade, unless otherwise shown to remain.

D. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings" and Addendum.

1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

3.6 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Patching is specified in Division 1 Section "Cutting and Patching."

C. Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

D. Restore exposed finishes of patched areas and extend finish restoration into adjoining construction to remain in a manner that eliminates evidence of patching and refinishing.

E. Patch and repair floor and wall surfaces in the new space where demolished walls or partitions extend one finished area into another. Provide a flush and even surface of uniform color and appearance.

1. Closely match texture and finish of existing adjacent surface.

2. Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

3. Where patching smooth painted surfaces, extend final paint coat over entire unbroken surface containing the patch after the surface has received primer and second coat.

4. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

5. Inspect and test patched areas to demonstrate integrity of the installation, where feasible.

F. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS
A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off EXCHANGE' property and legally dispose of them. Dispose all contaminated materials to an approved disposal site.

3.8 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

C. Refer to Drawings for items to be removed and reinstalled.

END OF SECTION 02 41 16
SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY
A. This Section specifies cast-in-place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1.2 SUBMITTALS
A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product Data: For proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Contracting Officer.
D. Samples of materials as requested by Contracting Officer, including names, sources, and descriptions.
E. Laboratory test reports for concrete materials and mix design test.
F. Materials certificates in lieu of materials laboratory test reports when permitted by Contracting Officer. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

1.3 QUALITY ASSURANCE
A. Codes and Standards: Comply with provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified:
   1. ACI 318, "Building Code Requirements for Reinforced Concrete."
   2. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
   3. ACI 301 "Specifications for Structural Concrete for Buildings."
B. Concrete Testing Service: Engage a testing laboratory acceptable to Contracting Officer to perform material evaluation tests for submittal.
C. EXCHANGE will engage and pay a testing lab to control testing during construction described by Item 3.16 below.
D. Materials and installed work may require testing and retesting at any time during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense. Allow free access to material stockpiles and facilities.
PART 2 - PRODUCTS

2.1 FORM MATERIALS

B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or another acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds with a maximum VOC of 350 mg/l that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

D. Form Ties: Factory-fabricated, adjustable-length, removable or snap-off metal form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1-1/2 inches to exposed surface.

1. Provide ties that, when removed, will leave holes not larger than 1 inch diameter in concrete surface.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed for #4 and larger bars. ASTM A 615, Grade 40, deformed for #3 bars.

B. Steel Wire: ASTM A 82, plain, cold-drawn steel.


D. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

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

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I.

1. Use one brand of cement throughout project.

B. Normal-Weight Aggregates: ASTM C 33 and as herein specified. Provide aggregates from a single source for exposed concrete.

1. Local aggregates not complying with ASTM C 33 but that special tests or actual service have shown to produce concrete of adequate strength and durability may be used when acceptable to Contracting Officer.

C. Water: Potable.

D. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions. Calcium chloride is not acceptable. Provide admixture manufacturer's written certification that chloride ion content complies with specific requirements.
E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. "Air-Mix" or "Perma-Air", Euclid Chemical Co.
   c. "Darex AEA" or "Daravair", W.R. Grace & Co.
   d. "MB-VR" or "Micro-Air", Master Builders, Inc.
   f. "Sika AER", Sika Corp.

F. Water-Reducing Admixture: ASTM C 494, Type A.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. "PSI N", Cormix.
   c. "Eucon WR-75", Euclid Chemical Co.
   e. "Pozzolith Normal" or "Polyheed", Master Builders, Inc.
   g. "Plastocrete 161", Sika Corp.

G. Water-Reducing, Accelerating Admixture: ASTM C 494, Type E.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. "Q-Set", Conspec Marketing & Manufacturing Co.
   b. "Gilco Accelerator", Cormix.
   c. "Accelguard 80", Euclid Chemical Co.
   e. "Pozzutec 20", Master Builders, Inc.

H. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. "Eucon Retarder 75", Euclid Chemical Co.
   d. "Pozzolith R", Master Builders, Inc.
   e. "Protard", Prokrete Industries.

2.4 RELATED MATERIALS

A. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.

B. Cure and Seal Compound: Typical concrete slab liquid membrane forming curing compound to be "Ashford Formula", Concrete Distribution, Inc., 1203 W. Spring Creek Place, Springville UT 84663
approximately 200 square feet per gallon in locations not receiving polished concrete floor finish.

2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Contracting Officer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing.

B. Slabs on Grade: It is the intent of the design that slabs on grade receive special attention for mix design. The submitted slab mix design is to incorporate proportioning to minimize paste content (minimize total water content) and provide a well-graded aggregate with maximum aggregate size (1” preferred). Gap graded mixes with primarily ¾” aggregate and sand will not be allowed.

C. Submit written reports to Contracting Officer for each proposed mix prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Contracting Officer.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Contracting Officer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Contracting Officer before using in Work.

2.6 ADMIXTURES

A. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

B. Use nonchloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).

D. Use air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content with a tolerance of plus or minus 1-1/2 percent within the following limits:
   1. 2 percent to 4 percent air.

E. Use admixtures for water reduction and set control in strict compliance with manufacturer's directions.

F. Slump Limits: See General Structural Notes on drawings.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements of ASTM C 94, and as specified.
   1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.8 REPAIR MATERIALS

A. Repair Underlayment Beneath Floor Finishes: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm).
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi (39 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.9 CONCRETE TYPES (INTERIOR AND EXTERIOR SLABS):
A. As indicated, provide concrete of specified strengths and mix designs with the following appearance characteristics:

PART 3 - EXECUTION

3.1 GENERAL
A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

3.2 FORMS
A. General: Design, erect, support, brace, and maintain formwork to support vertical and lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain formwork construction tolerances complying with ACI 347.
B. Construct forms to sizes, shapes, lines, and dimensions shown and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.
C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
D. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

E. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

F. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.

G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing before concrete placement, as required, to prevent mortar leaks and maintain proper alignment.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as herein specified.

1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as approved by Contracting Officer.

D. Place reinforcement to maintain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. Construction Joints: Locate and install construction joints as indicated on the structural drawings or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Contracting Officer.

C. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.

D. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere, as indicated.

1. Joint filler and sealant materials are specified in Division 7 Section "Joint Sealants."
F. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use saw cuts 1/8 inch wide by one-fourth slab depth.

1. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate. Joints MUST be made within 6 hours of finishing floors, and in no case shall cuts be made later than 12 hours from placement.

2. Apply joint sealant to all exposed contraction joints. Color selected to match adjacent surface. Joint sealant material is specified in Division 7 Section "Joint Sealants."

3.5 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto.

B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to obtain required elevations and contours in finished surfaces. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.6 VAPOR RETARDERS

A. Vapor Retarder: There is no underslab vapor retarder in this project.

3.7 PREPARATION OF FORM SURFACES

A. General: Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.

B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Clean reused forms of concrete residue, repair and patch as required to return forms to acceptable surface condition.

C. Coat steel forms with a nonstaining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.8 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

B. General: Comply with ACI 304, "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

C. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.

D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

E. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.

1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
3. Maintain reinforcing in proper position on chairs during concrete placement.

F. Hot-Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete.
4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, when acceptable to Contracting Officer.

G. Cold-Weather Placing: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
   a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   b. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

3.9 FINISH OF FORMED SURFACES

A. Rough-Form Finish: For formed concrete surfaces not exposed to view in the finish Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

3.10 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

C. Curing Methods: Perform curing of concrete by curing and sealing compound, by moist curing, by moisture-retaining cover curing, and by combinations thereof, as herein specified.

1. Provide moisture curing by following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Use continuous water-fog spray.
   c. Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows:
   a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

D. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

E. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces, by application of appropriate curing method.

F. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.12 REMOVAL OF FORMS
A. General: Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulative curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form-removal operations, and provided curing and protection operations are maintained.

3.13 REUSE OF FORMS
A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces except as acceptable to Contracting Officer.

3.14 MISCELLANEOUS CONCRETE ITEMS
A. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Contracting Officer.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar before bonding compound has dried.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Contracting Officer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

1. Repair concealed formed surfaces, where possible, that contain defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

C. Repair isolated random cracks and single holes not over 1 inch in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry-pack before bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

D. Perform structural repairs with prior approval of Contracting Officer for method and procedure, using specified epoxy adhesive and mortar.

E. Repair methods not specified above may be used, subject to acceptance of Contracting Officer.

3.16 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. General: EXCHANGE will employ a testing laboratory to perform tests and to submit test reports.

B. Sampling and testing for quality control during concrete placement may include the following, as directed by Contracting Officer.

C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

1. Slump: ASTM C 143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

2. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one for each day's pour of each type of air-entrained concrete.

3. Concrete Temperature: Test hourly when air temperature is 40 deg F (4 deg C) and below, when 80 deg F (27 deg C) and above, and each time a set of compression test specimens is made.

4. Compression Test Specimen: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless otherwise directed. Mold and store cylinders for laboratory-cured test specimens except when field-cure test specimens are required.

5. Compressive-Strength Tests: ASTM C 39; at least one set for each day's pour, or not less than once for each 150 cubic yards of concrete, or not less than once for each 5,000 s.f. of surface...
area for slabs or walls; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

a. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

b. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

c. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.

D. Test results will be reported in writing to Contracting Officer, Structural Engineer, ready-mix producer, and Contractor within 24 hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

F. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Contracting Officer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests when unacceptable concrete is verified.

END OF SECTION 03 30 00
SECTION 03 35 36
POLISHED CONCRETE FLOOR FINISH

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Installation of polished concrete floor system for new and/or existing interior concrete floors by dry
grinding, application of concrete densifier, and polishing with various size grit metal-bonded and resin-
bonded diamonds to the scheduled specified minimum local and overall gloss values.

B. Removal of existing epoxy, ceramic, carpet, and/or vinyl composite tile floor finish, and all underlayment
products where shown on drawings.

C. Application of chemical dye and complementary edge band treatment.

1.2 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

B. Section 03 30 00 – Cast-in-Place Concrete.

C. Section 03 35 40 – Interior Concrete Slab Repairs and Joint Filler Replacement.

D. Division 09 – Finishes

1.3 REFERENCES


1.4 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data:
   1. Provide manufacturer’s equipment product data sheets for:
      a. Planetary grinder polishing equipment
      b. Planetary grinder HEPA dust collection equipment
      c. Hand tools
      d. Hand tool dust collection equipment
      e. Diamond tooling
      f. High speed propane burnisher
      g. Polyurea pump
      h. Joint cutting saw
   2. Manufacturer’s chemical and product data sheets for:
      a. Liquid reactive surface densifier
      b. Liquid stain guard treatment
      c. Joint filler
      d. Crack and spall repair product
      e. Self leveling, dye-able, polishable overlay product
      f. Grout coat, pin hole and small defect surface treatment
C. Installer’s Certification:
   1. Provide list of 5 projects performed with last three years of similar type, size and complexity. Submit project names, addresses, contacts and phone numbers for each project. General Contractor is to validate references and polisher’s capabilities prior to submitting bid to AAFES.
   2. Applicator Qualifications: Submit letter of certification from each of the following manufacturers of products and equipment specified herein, stating that the applicator is a certified applicator of the system and is familiar with proper procedures and installation methods as required by the manufacturer.
      a. Planetary grinder system
      b. Liquid reactive surface densifier and stain guard treatment
      c. Joint filler, crack and spall repair products

D. Pre-Certified Installers

   All bidding contractors must have completed our in house certification for this project. Below is a list of pre-approved applicators.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) American Concrete Inc.</td>
<td>877-775-0030</td>
</tr>
<tr>
<td>2) Ardor Solutions</td>
<td>843-900-1100</td>
</tr>
<tr>
<td>3) Bomanite of North Texas</td>
<td>800-492-2524</td>
</tr>
<tr>
<td>4) Budget Maintenance Concrete</td>
<td>610-323-7702</td>
</tr>
<tr>
<td>5) Diama-Shield</td>
<td>888-730-4075</td>
</tr>
<tr>
<td>6) Jeffco Concrete Contractors</td>
<td>800-226-2668</td>
</tr>
<tr>
<td>7) K &amp; J Concrete Polishing</td>
<td>865-971-1760</td>
</tr>
<tr>
<td>8) Pacific Decorative Concrete</td>
<td>916-725-9269</td>
</tr>
<tr>
<td>9) Perfect Polish Inc.</td>
<td>877-917-4463</td>
</tr>
<tr>
<td>10) Stone Care of Texas</td>
<td>210-656-8019</td>
</tr>
</tbody>
</table>

**Refer to specifications Division 1 for substitution qualifications. Any potential contractor substitution must have their complete submittal package submitted in writing through a General Contractor a minimum of 10 days prior to bid date to the AAFES Contracting Officer for review and approval.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Accessibility Requirements: Comply with applicable requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAGs) for Buildings and Facilities; Final Guidelines, revisions, and updates for static coefficient of friction for walkway surfaces.
   2. Environmental Requirements: Comply with current Federal and local toxicity and air quality regulations and with Federal requirements on content of lead, mercury, and other heavy metals. Do not use solvents in floor polish products that contribute to air pollution or impact food quality.

B. Pre-installation Meeting:
   1. General contractor shall schedule and convene a pre-installation meeting at the project site before start of installation of polished concrete floor system.
   2. Meeting to occur only after review and approval of required Sub-contractor submittals and completion of test panel mock-up, including specified grinding, polishing and dye, joint filling, spall and crack repairs, and specified overall gloss values.
3. Require attendance of parties directly affecting work of this section, including:
   a. AAFES Project Manager
   b. AAFES Store Manager of Assistant Manager
   c. Project Architect
   d. Owner’s Polishing Consultant
   e. General Contractor
   f. Polishing Subcontractor including Project Manager and Foreman

4. Meeting agenda to include (but not limited to): Review of existing conditions, surface preparation, system installations, field quality control, protection, environmental requirements, coordination with other work, controls to limit damage from dust and field quality control methods and reporting.

1.6 MOCK-UP
A. Provide polished concrete floor finish mock-up, a minimum of 250 square feet, illustrating completed finish including dye, all specified liquid surface treatments and specified gloss levels.
   Mock-up will include properly joint treatment and on remodels include correctly repaired surface spalls and slab edge treatments per specification section 033540.
B. Locate mock-up where directed by AAFES Project Manager.
C. Accepted mock-up will serve as standard to judge quality and workmanship of completed polished concrete floor finish.
D. Accepted mock-up shall remain as part of finished product.

1.7 PROJECT CONDITIONS
A. Sequence application of concrete polishing after completion of other construction activities that would be damaging to the completed polished concrete finish.
B. Close areas to traffic during and after floor application for time period recommended in writing by manufacturer.

PART 2 PRODUCTS AND EQUIPMENT

2.1 EQUIPMENT TO BE USED FOR INSTALLATION
A. Floor Grinder:
   1. Machinery manufacturer will be HTC, SASE, Concrete Polishing Solutions, Husqvarna, Diamatic or PrepMaster.
   2. Type: Multi-orbital, planetary-action, opposing-rotational, 3 or 4 diamond-headed floor grinders.
   3. Weight: 850 pounds or more.
B. Dust Extraction System and pre-separator for grinding/polishing:
   Heavy-duty industrial HEPA filtration vacuum system, suitable for extracting and containing large quantities of fine concrete dust (minimum 350 CFM air flow) in conjunction with manufacturer recommended pre-separator:
   1. HTC 86D
   2. Pullman-ÉrmaT T8600
   3. SASE Bull 1250
   4. Approved equal
C. Diamond Tooling for Coating Removal, Initial Grinding, and Preparing Floor for Polishing:
   1. Metal Bonded Diamonds
      a. Grit Size: 40, 80, and 150.
      *Reference Section 3.3 C

D. Diamond Tooling for Polishing Concrete:
   1. Resin Bonded, Phenolic Diamonds
      a. Grit Size: 100, 200, 400, 800 and 1500 or equivalent.

E. Grinding / Polishing Pads for Edges
   1. Grit Size: 80, 100, 120, 200, 400, 800, 1500 and 3000.

E. Hand Grinder with dust extraction attachment and pads.

F. Joint cutting saw with dust extraction attachment
   1. The Mongoose, by Engrave-a-Crete
   2. Dust Buggy, by US Saws
   3. Hump Back, by Joe Due

H. Self-propelled shaver/leveler for slab surface demolition and leveling.
   1. SuperShaver, by CPS
   3. BMC 335 Shaver, by Diamatic

I. High speed propane burnisher
   1. Minimum 27 inch head generating pad speeds of 2,500 RPM or higher.

J. Diamond Impregnated Burnisher Pads
   1. Twister Diamond Cleaning System Pads, by HTC
   2. Diamond Polishing Pads, by Norton
   3. SpinFlex Diamond Polishing Pads, by CPS

2.3 MATERIALS

A. Penetrating Hardener/Densifier: Clear liquid reactive lithium-silicate based.
   2. RetroPlate 99 by Advanced Floor Products.
   3. FGS Permashine by L&M Construction Chemicals.
   4. SureLock Densifier by Ameripolish
   5. No Substitutions

B. Protective Surface Treatment (Stain Guard):
   1. Consolideck LS Guard, by Prosoco.
   2. RetroGuard by Advanced Floor Products
   3. FGS Stain Protection by L&M Construction Chemicals.
   5. No Substitutions

C. Solvent Based dye (where needed for repairs or per plans)
   1. AmeriPolish Acetone Solvent Based Dye
   2. Prosoco GemTone Dye (Applied with Acetone ONLY)
   2. No Substitutions
D. Joint Filler
1. SL/65 Polyurea in complementary darker color to match Dyed Polished Concrete, by VersaFlex Inc.
2. RS65 Polyurea in complementary darker color to match Dyed Polished Concrete, by Metzger McGuire
3. HT-PE65 Polyurea in complementary darker color to match Dyed Polished Concrete, by Hi-Tech Systems
4. Colors to be matched as closely as possible using a chip set match provided by the owners polishing consultant. Manufacturer to produce product to match this color selection.

E. Low Viscosity Crack and Spall Repair
1. Quick-Mender in complementary matching color, by VersaFlex Incorporated
2. Rapid Refloor in complementary matching color, by Metzger McGuire
3. HT Spall-FX2 in complementary matching color, by Hi-Tech Systems
4. 10 Minute Mender or Matchcrete in complementary color, by Roadware
5. Colors to be reviewed and approved by AAFES Project Manager or Polished Concrete Consultant in mock-up.

F. Wide Area Surface Repairs
1. TRU Self Leveling, by CTS Cement Manufacturing Corporation
2. Diama-Top by Ardex Engineered Cements
3. Color after application of Specified Dye to be reviewed and approved by AAFES Project Manager or Polished Concrete Consultant in mock-up

G. Pin Hole and Surface Pitting Grout Coat
1. GM 3000, by Husqvarna Construction Products
2. StarSeal Fusion, by Vexcon Chemicals, Inc
3. Diama-Fill, by Ardex Engineered Cements
4. Approved Equal
5. Color after application to be reviewed and approved by AAFES Project Manager or Polished Concrete Consultant in mock-up.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine floor to receive polished concrete floor system.

B. Notify the Project Manager of conditions that would adversely affect installation or subsequent use prior to commencement of polishing.

C. Do not begin surface preparation or installation until conditions are corrected and approved.

D. Verify the Following for New Overlays in Mud Beds
1. Floor Finish: Wide channel floated, smooth, pan, combination blade and plastic blade finished floor from edge to edge, with no rough areas.
2. Floor and Joints:
   a. Free of debris and excessive dirt, dust, clay, and mud.
   b. Dry.
3. Concrete Curing: Minimum 7 days disposable wet curing blankets or removable curing compound applied. Concrete shall be cured for 14-days minimum before start of grinding process.
4. Concrete Adjacent to Floor Penetrations: Troweled flat and level with surrounding concrete.
3.2 SURFACE PREPARATION

A. Protection: Protect surrounding areas and adjacent surfaces from the following:
   1. Minimal accumulation of dust from grinding and polishing.
   2. Contact with overspray of penetrating hardener / densifier.
   3. Contact with overspray of protective surface treatment (stain guard)
   4. Contact with joint filler, crack or spall repair materials

B. On existing concrete floors, completely remove existing flooring, mastics, adhesives, self-leveling underlayment fillers and other foreign matter.

C. On existing concrete floors, remove the top ½ of an inch of existing joint material and replace with approved joint filler and crack repair products.

D. Clean Surfaces: Remove dirt, dust, debris, oil, grease, curing agents, bond breakers, paint, coatings, and other surface contaminants which could adversely affect installation of polished concrete floor system.

E. Fill concrete joints in accordance with Section 07900.

F. Repair all slab defects and joints in accordance with Section 03 35 40

3.3 INSTALLATION

A. Install polished concrete floor system in accordance with manufacturer’s instructions at locations indicated on the Drawings.

B. Aggregate Exposure:

C. Polished Concrete Floor System
   1. Open Slab Surface:
      a. As required to provide a uniform final polish or removal of existing floor coatings, begin grinding with 40 or 80-grit metal bond. Bids shall be based on starting initial cut with 40-grit metal diamonds. Expose coarse concrete aggregate when required to reach lows spots within floor surface.
      b. Review condition of floor with AAFES Project Manager. Obtain approval from AAFES Project Manager if large coarse aggregate is required to be exposed to remove existing coatings, floor underlayment or slab deficiencies. Variations to the precise grinding, densifying, polishing and stain guard application are anticipated, but must be discussed and approved in writing by the AAFES Project Manager prior to executing the work.
      c. For new concrete floors, open-up concrete by grinding with 80-grit metal-bonded.
      d. Progressive edge grinding will be necessary with ½” of all vertical abutments, including walls, cases, columns, posts and racking systems.
      e. Joint filler shall be flush with surface after grinding and polishing steps. Additional passes along curled joints may be necessary to even the surfaces and remove joint filler chatter.

   2. Remove metal-bonded diamond scratches by grinding with progressively finer metal-bonded diamonds, up to metal bond 150-grit.

   3. Apply densifier
      a. Apply to the point of rejection to ensure complete acceptance of the densifier product per manufacturer’s recommendations.
4. **Floor Polishing:**
   a. Remove 150-grit metal-bonded diamond scratches by grinding with a transitional diamond per manufacturers recommendation.
   b. Remove transitional resin-bonded diamond scratches by grinding with 100-grit resin-bonded diamonds.
   c. Remove 100-grit resin-bonded diamond scratches by grinding with 200-grit resin-bonded diamonds.
   d. Remove 200-grit resin-bonded diamond scratches by grinding with 400-grit resin-bonded diamonds.
   e. Remove 400-grit resin-bonded diamond scratches by grinding with 800-grit resin-bonded diamonds.
   f. Remove 800-grit resin-bonded diamond scratches by grinding with 1500-grit resin-bonded diamonds.

5. **Apply stain guard**
   a. Apply in accordance with manufacturer’s published instructions.
   b. Apply first coat per manufacturer’s recommendation (DO NOT OVER APPLY).
   c. Use applicator pad, pre-wetted with stain guard, to pull material out to create a thin film prior to drying.
   d. Remove product completely from areas of over application, as evidenced by surface streaking, and replace with unused stain guard.
   e. Apply second coat of stain guard at all high traffic areas identified on the drawings per manufacturers instructions.

6. **High speed burnish:**
   a. After each application of stain guard is dry, burnish surface.
   b. Burnish using approved pads, at a slow movement pace using high speed machine with 400 or 800 grit diamond impregnated pads as required to achieve specified gloss requirements.
   c. Burnish with several passes. Make each progressive pass at 90 degrees from previous pass.
   d. Burnishing, pad type, and pace of forward movement shall combine to develop a minimum floor surface temperature of 91-degrees F directly below the burnishing pad as continuously measured by the operator during installation.

D. **Penetrating Dye**
   1. Mix dye in accordance with manufacturer’s instructions for use in blending and matching patches.

Design Standards are to be as follows:

**Shoppette’s**
Polish existing concrete with no color unless specifically called out in specifications or plans.

**Main Store’s**
Polish existing concrete with no color unless specifically called out in specifications or plans.

3.4 **FIELD QUALITY CONTROL**
   A. Inspect completed polished concrete floor system with the Concrete Consultant, Contractor, and Installer.
   B. Review procedures with Contracting Officer to correct unacceptable areas of completed polished concrete floor system.
C. Specular Gloss/Reflectance, ASTM D 523:
   1. Perform polishing and burnishing work necessary to produce a Specified Overall Gloss Value (SOGV) ≥ 50 prior to applying protective surface treatment, SOGV ≥ 60 after applying protective surface treatment, Minimum Local Gloss Value (MLGV) ≥ 40 after applying protective surface treatment as measured using a Horiba IG-320 60 Degree Gloss Checker.
   2. Gloss shall be considered as a quantitative value that expresses the degree of reflection when light hits the concrete floor surface. Gloss measurements will be taken independent of ambient lighting and will be taken within a sealed measurement window located beneath the test unit.
   3. Collects 12 readings minimum, throw out low and high measurements and average remaining measurements. Average shall exceed SOGV. No single measurement shall be less than MLGV.

3.5 PROTECTION

A. Protect completed polished concrete floor system from damage until Substantial Completion.
   1. Do not allow vehicle and pedestrian traffic on unprotected floor.
   2. Do not allow construction materials, equipment, and tools on unprotected floor.
   4. If construction equipment must be used for application, diaper components that might drip oil, hydraulic fluid, or other liquids.
   5. No tire embedments (rocks, nails, screws, etc.) that will scratch or pit slab surface.
   6. Prohibit pipe cutting using pipe cutting machinery on concrete slab.
   7. Prohibit temporary placement and storage of steel members on concrete slab.
   8. Prohibit acids and acidic detergents from contacting concrete surfaces.
   9. Cover concrete floors with drop cloths or use breathable drop cloths during painting. If paint is spilled on concrete floor, remove paint immediately.
   10. Protect slab surface from standing moisture for 72 hours to prevent re-emulsification of surface treatment prior to cure

B. Immediately remove mortar splatter, spilled liquids, oil, grease, paint, coatings, and other surface contaminants which could adversely affect completed polished concrete floor system.

C. Repair damaged areas of completed polished concrete floor system to satisfaction of Contracting Officer.

END OF SECTION
SECTION 03 35 40

INTERIOR CONCRETE SLAB REPAIRS AND JOINT FILLER REPLACEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joint filler removal and replacement, with or without metal keyway.
   a. Contractor is to provide unit price per linear foot in Section 012200 for joint filler removal and replacement based on the following formula:
      1) Total Area to be Polished X 0.14 = Total Projected Linear Feet of Joint Filler Removal and Replacement to be Included and Broken Out in the Bid.

2. Spalled joint repair or joint with metal keyway (less than 3/4”)
   a. Contractor is to provide unit price per linear foot in Section 012200 for keyway segment removal and filler installation based on the following formula:
      1) Total Area to be Polished X 0.08 = Total Projected Linear Feet of keyway segment removal to be Included and Broken Out in the Bid.

3. Spalled joint repair, joint with metal keyway or self-leveling compound removal (greater than 3/4”)
   a. Contractor is to provide unit price per linear foot in Section 012200 for keyway segment removal and repair material installation based on the following formula:
      1) Total Area to be Polished X 0.08 = Total Projected Square Feet of keyway segment and self-leveling compound removal and repair material installation to be Included and Broken Out in the Bid.

   a. Contractor is to provide unit price per linear foot in Section 012200 for crack cleaning and filling based on the following formula:
      1) Total Polished Area X 0.03 = Total Projected Linear Feet of Crack Repair to be Included and Broken Out in the Bid.

5. Surface defect repair, including pop-outs, spalls, and gouges.
   a. Contractor is to provide unit price per occurrence in Section 012200 for pop-out and spall repair based on the following formula:
      1) Total Polished Area X 0.025 = Total Projected Occurrences of 3/4” to 1-1/2” DIA X 1/2” Deep Pop-Outs or Spalls to be Included and Broken Out in the Bid.
      2) Total Polished Area X 0.025 = Total Projected Occurrences of 1-1/2” to 3” DIA X 1/2” Deep Pop-Outs or Spalls to be Included and Broken Out in the Bid.

6. Surface embed repair, including cleanouts, in-floor electrical outlets and Walker Duct access holes.
   a. Contractor is to provide unit price per occurrence in Section 012200 for over-coring cleanouts, in-floor electrical outlets and Walker Duct access holes based on the following formula.
      1) Total Polished Area X 0.001 = Total Projected Occurrences of 4” average DIA X 1/2” Deep Pop-Outs or Spalls to be Included and Broken Out in the Bid.

7. Large area surface repair, existing underlayment removal/replacement and delamination repair.
   a. Contractor is to provide unit price per square foot in Section 012200 for large area surface repair of rough surface, or removal and replacement of existing underlayment’s > 3/8” in thickness.
      1) 3/8” Minimum Thick Polished Overlay Topping to be Included as a Unit Cost

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8. Grout coat surface enhancement, including air voids, micro-pin holes, pitting and other shallow surface deficiencies.
   a. Contractor is to provide unit price per square foot in Section 012200 for grout coat surface enhancement based on the following formula:
      1) Total Polished Area X 0.10 = Total Projected Square Feet of Grout Coat to Include and Breakout in Bid.

9. Full Grind, Densify and Polish portions of the project not currently indicated on the drawings.
   a. Contractor is to provide unit price per square foot in Section 012200 to provide a Full Grind, Densify and Polish for portions of the project not currently indicated on the drawings.
      1) Full Grind, Densify and Polish to be Included as a Unit Cost

1.2 SUBMITTALS

A. Section 01330 - Submittal Procedures: Procedures for Submittals.

B. Joint Filler Installer Qualification Certification:
   1. Submit letter of certification, identifying specific individuals that are currently certified installers of the specified materials and are familiar with proper procedures and installation methods as required by the specified product manufacturers.

C. Product data for:
   1. All products and primary equipment used for repair of existing concrete slab defects.

1.3 QUALITY ASSURANCE

A. AAFES reserves the right to engage the services of a Concrete Consultant to review, observe and inspect the work in progress.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Limit and control damage from excessive dust caused by demolition, preparation, and installation of all Work.

B. Limit and control damage from moisture.

C. All replaced concrete shall be cured a minimum of 12 calendar days prior to joint filler installation.

D. Concrete repair area shall be closed to traffic during preparation and repair for a time as recommended by manufacturer.

PART 2 - PRODUCTS and EQUIPMENT

2.1 MATERIALS

A. Polyurea Joint Filler: Rapid setting, two-component polyurea polymer liquid of 100% solids content, Shore hardness 60 - 65, compatible with construction materials in contact.
   1. SL/60 Polyurea in complementary darker color to match Polished Concrete, by VersaFlex Incorporated
   2. RS65 Polyurea in complementary darker color to match Polished Concrete, by Metzger/McGuire.
   3. HT-PE65 Polyurea in complementary darker color to match Polished Concrete, by Hi-Tech Systems
   4. Colors to be reviewed and approved by AAFES Project Manager or Consultant in mock-up.
B. Joint Filler Stain Preventing Film:
   1. SPF by Metzger/McGuire.

C. Low Viscosity Crack and Spall Repair:
   1. Quick-Mender in complementary matching color, by VersaFlex Incorporated
   2. Rapid ReFloor in complementary matching color, by Metzger/McGuire.
   3. HT Spall-FX2 in complementary matching color, by Hi-Tech Systems
   4. Colors to be reviewed and approved by AAFES Project Manager in mock-up.

D. Wide Area Surface Repairs
   1. PC-5614 Polishable Overlay by Diamatic,
   2. DuraFloor TGA, by L&M/Laticrete
   3. No Substitutions
   4. Color after application of Specified Dye to be reviewed and approved by AAFES Project Manager in mock-up.

E. Pin Hole and Surface Pitting Grout Coat
   1. RSG, by Diamatic Inc.
   2. GM 3000, by Husqvarna Construction Products
   3. Versa-Grout, by VersaFlex
   4. Color after application to be reviewed and approved by AAFES Project Manager in mock-up.

2.2 EQUIPMENT

A. Dust extraction system for grinding/sawing:
   1. HEPA filtration vacuum, designed for use with all hand tools when grinding or sawing concrete (minimum 125CFM air flow).
   2. Provide one of the following:
      a. 26D, by HTC.
      b. S2400, by Pullman-Ermator.
      d. Approved equal.

B. Joint Filler Removal and Preparation
   1. The Mongoose, by Engrave-a-Crete
   2. Humpback Cutter Complete, by Joe Due.
   3. Dust Buggy, by U.S. Saws.
   4. Approved equal.

C. Crack Repair:
   1. 5" Dustmizer 007, by Joe Due.
   2. 5" Crack Attacker, by Joe Due.
   3. 7" Handheld Crack Chaser, by Joe Due.
   5. SawTec 7" Crac-Vac, by U.S. Saws.
   6. Approved equal.

D. Surface Grinder: Handheld 4”-7” electric surface grinder with dustless shroud/housing.
   1. Dust Avenger 5, by Joe Due.
   2. Dust Avenger 7, by Joe Due.
   4. SawTec 7” Grinder Vac, by U.S. Saws.
   5. Approved equal.
PART 3 - EXECUTION

3.1 EXAMINATION

A. An evaluation of the existing floor slab shall be conducted, identifying all defects. Scope of repairs shall be confirmed by the AAFES Project Manager, Architect of Record, or AAFES Concrete Consultant prior to commencement of work. Identify scope of work on Floor Polishing Plan specified in other section(s) of Division 3 – Concrete.

B. Repairs are not to be conducted until Unit Price in attached Worksheet has been reviewed and approved by the AAFES Contracting Officer.

C. Repairs exceeding the Estimated Scope of Repairs developed in the attached Worksheet and included in the Base Bid must be approved by the AAFES Contracting Officer prior to executing the work in any new Phase.

3.2 PREPARATION

A. Protect surface of slab immediately adjacent to defect under repair.

3.3 JOINT MILLING AND CAP FILLER REPLACEMENT

A. If existing joint filler is sound and resting on top of saw cut shelf, mill top 1/2” of material and refill with specified Polyurea joint filler.
   1. Re-saw the joint to a minimum depth of 1/2” with a dry-cut, vacuum-equipped saw using a slightly oversized blade. The blade width should be sufficient to encapsulate the widest spall along a given contraction joint segment to produce a sharp corner on each side of the joint with a minimum of two passes through the joint.
   2. Refill with polyurea joint filler material from the bottom up, taking care not to entrap large air bubbles per manufacturer’s recommendation. Slightly overfill and shave flush to the surface after the grinding process has been completed.
   3. Ensure that after grinding, the joint is cut smooth and flush with the finish floor surface, without concave or intermittent, darkened profile.
3.4 FULL DEPTH JOINT FILLER REPLACEMENT

A. If existing joint filler is loose, easily removed, or able to be forced downward with a hand tool, remove all filler material from joint and refill.
   1. Re-saw joint full depth with a dry-cut, vacuum-equipped saw using a slightly oversized blade. The blade width should be sufficient to encapsulate the widest spall along a given contraction joint segment to produce a sharp corner on each side of the joint with a minimum of two passes through the joint. Remove all filler material, debris, and laitance.
   2. Refill with polyurea joint filler material from the bottom up, taking care not to entrap large air bubbles per manufacturer’s recommendation. Slightly overfill and shave flush to the surface prior to grinding process.
   3. Ensure that after grinding, the joint is cut smooth and flush with the finish floor surface, without concave or intermittent, darkened profile.

3.5 NARROW SPALLED JOINT REPAIR OR JOINT WITH METAL KEYWAY (LESS THAN 3/4”)

A. For joints that are spalled, are constructed with metal keys or have radius tooled edges not exceeding 3/4” in width at slab surface.
   1. Re-saw the joint edge to a minimum depth of 3/4” with a dry-cut, vacuum-equipped saw allowing removal of the widest spall (or top of radius) along a given joint segment to produce a sharp corner on each side of the joint with a minimum of two passes through joint.
   2. Clean joint of loose concrete, metal key fragments, joint filler, laitance, dirt, debris, backer rod, etc.
   3. Joints must be free of all visible moisture.
   4. Ensure filler penetrates the irregular aggregate interlock portion of the sawn contraction joint as shown below, re-establishing the aggregate interlock that may have been lost due to shrinkage, curling, and lack of reinforcement.
5. Fill joint cavity with specified Polyurea joint filler per manufacturer’s instructions, taking care not to entrap large air bubbles. Overfill joint slightly and shave flush to slab surface after the grinding process has been completed.

3.6 WIDE SPALLED JOINT REPAIR (GREATER THAN 3/4”)

A. For joints that are spalled, contain metal key or self leveling floor material that exceeds 3/4” in width at slab surface.
   1. Re-saw the joint edge to a minimum depth of 1/4” with a dry-cut, vacuum-equipped shaver/leveler allowing removal of the widest spall or non-linear keyway along a given joint segment to produce a sharp corner on each side of the joint with a minimum of two passes through joint. Maintain consistent width of repair to within 1/2 inch in 10 feet.
   2. Overfill repair cavity with overlay material per manufacturer’s instructions and grind flush to slab surface.
   3. After repair has cured, and prior to any traffic on patched surface, re-saw original slab joint(s) ¾” in depth to honor joint and fill full depth with Polyurea joint filler per manufacturer’s instructions.

3.7 CRACK REPAIR

A. Crack width less than 1/32” without surface spalling.
   1. Do not repair.
   2. Grout coat may be used to fill thin hairline deficiencies.

B. Cracks from 1/32” to 1/4” in width.
   1. Clean crack cavity.
2. Remove loose concrete, dirt and debris from crack with a wire brush or hand grinder with twisted wire wheel attachment, 1/2” minimum depth, insuring crack sidewall is clean.
3. Remove any loose segments, including islands formed by crack, with sharp tool.
4. Use methods that will not widen existing crack.
5. Vacuum crack to remove all dirt, debris and other laitance.
6. Mask slab surface along crack as necessary to minimize overfill.
7. Choose material color that closely matches the adjacent floor.
8. Install low viscosity crack and spall repair material in accordance with manufacturer’s instructions.
9. Repeat until all voids are filled and material crowns slab surface.
   a. Do not flood area around crack.
   b. Watch for bubble formation and outgassing.
   c. Do not allow material to gel before adding additional material.
10. Shave or grind material flush to surface as stipulated by manufacturer.

3.8 SURFACE SPALLING REPAIR

A. For slab surface that is chipped and spalled, where the deficiency is 1/2” in length or width up to 3” in length or width, by 1/2” in depth.
1. Route edge of spall to provide 1/8” deep square edge or 30° edge (consult manufacturer’s data sheet for specific surface preparation instructions).
2. Use small hand grinder with maximum 5” diameter dry diamond blade and vacuum system attachment.
3. Do not overcut slots into existing slab surface.
4. Clean and prep spalled cavity.
5. Wire brush spalled surface to remove all dirt and laitance.
6. Mask slab at perimeter of spall with tape.
7. Install Low Viscosity Crack and Spall Repair material.
8. Polish over repair area with diamond disks to blend surface.
9. Feather filler material into the adjacent concrete floor surface.
10. With 2000 grit disk and firm pressure, add a few burn marks to mottle surface to blend with adjacent floor surface.
   a. NOTE: For inconsistent, varying spalled joints that comply with the measurements in this section, a form material may be needed to temporarily form and support the vertical face of spalled joint edge. Ensure that the repair material will not adhere to the form and the rigid repair material does not fuse the joint together.
11. For cleanouts, in-floor electric outlets and Walker Duct access plates, over-core around perimeter of existing embed by 1/2” in width and depth, then install Low Viscosity Crack and Spall Repair Material.
3.9 BOLT HOLE, CONDUIT REPAIR

A. For slab surfaces containing surface or sub-surface bolts, bolt-hole voids, conduit or subsurface conduit.
   1. Recess steel bolt or conduit a minimum of 1/2” below finish floor by either punching or cutting.
      a. Check with General Contractor prior to cutting into active electrical or communication conduit.
   2. For spall fractured edges less than 30 degrees, square edge to a minimum 1/8” depth with either a drill bit, chisel or edge grinder.
   3. Clean cavity of all debris and laitance with drill activated, brass wire wheel. Vacuum hole to remove all dirt, debris and other laitance.
   4. Dispense Low Viscosity Crack and Spall Repair at moderate pace using steady pressure. Dispense material into void, refilling as necessary to produce slight crown.
   5. Grind material flush to slab surface per manufacturer’s instructions.

3.10 LARGE SURFACE REPAIR, UNDERLAYMENT REMOVAL AND REPLACEMENT

A. For slab surfaces containing wide-area irregular rough surfaces greater than 3” in width and length such as irregular coarse aggregate surfaces or surfaces with existing tile or carpet underlayment’s > 1/4” in thickness or surface paste delaminations.
   1. Define edge perimeter with diamond masonry wheel or shaver/leveler to produce sharp edge, at least 3/8” deep.
   2. For delaminations test to determine the extent of the delaminated area. From the current edge extend repair 6” in all directions. Define a square or rectangular repair area and create an edge perimeter. Do not overcut into surrounding surface.
   3. Roughen base surface using shaver/leveler to ICRI CSP 3 – 5 and vacuum clean.
   4. Wire brush to remove any small loose material and vacuum again.
   5. Mix and install overlay material in accordance with manufacturer’s instructions.
   6. Place repair material in floor surface defect, float level or leave slightly proud of existing floor.
   7. Grind, densify and polish to match adjacent concrete.
   8. Re-establish original concrete slab joints by sawing completely through patch and re-filling with Polyurea joint filler prior to exposure to traffic.

3.11 SMALL SURFACE PITTING, PINHOLE REPAIR, GROUT COAT

A. For surfaces consisting of micro-deficiencies, pin holes, hairline cracks and other surface clutter that impedes the achievement of the specified overall gloss values
   1. Clean pitted sections with 90-degree angle grinder equipped with wire wheel to remove all dirt/laitance. Wheel should be run over defect in multiple directions to ensure proper cleaning.
   2. Vacuum prepared pitted sections.
   3. Install and disperse grout coat using RSG by Diamatic, GM 3000, or Versa-Grout in accordance with manufacturer’s directions.
4. Ensure a thin, uniform layer of repair material covers the pitted areas. Refill any low spots as needed.
5. Grind or polish flush with metal or resin-bond diamonds, ensuring repair material is flush with slab surface.
6. Repeat repairs in areas as required if repair material pulls out of defects.
7. Apply required applications and polish smooth to meet specified overall gloss values.

3.12 PROTECTION

A. Protect surfaces of finished floor.

B. Prohibit traffic until floor repairs have received final approval by Owner.

**The Worksheet Below is to be included in the bid.**

END OF SECTION
WORKSHEET
INTERIOR CONCRETE SLAB ENHANCEMENT, REPAIR AND JOINT FILLER REPLACEMENT
(To Be Turned in with Sub-Contractor’s Bid Behind Form 4450-024, Page 2)

ENTER TOTAL AREA TO BE POLISHED: ______________ SQUARE FEET

<table>
<thead>
<tr>
<th>ITEM</th>
<th>AREA FROM ABOVE</th>
<th>MULTIPLIER</th>
<th>TOTAL FROM MULTIPLIER</th>
<th>UNIT RATE INCLUDED IN BID</th>
<th>TOTAL COST INCLUDED IN BID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Filler Removal and Replacement</td>
<td>36,000</td>
<td>0.14</td>
<td>5014 LF</td>
<td>$2.75 / LF</td>
<td>$13,788.50</td>
</tr>
</tbody>
</table>

….. SAMPLE CALCULATION….. NOT PART OF BID …..

1. Joint Filler Removal and Replacement
   
   _____ 0.14 _____ LF $_______ / LF $_______

2. Spalled joint repair or joint with metal keyway (less than 3/4”)
   
   _____ 0.08 _____ LF $_______ / LF $_______

3. Spalled joint repair, joint with metal keyway or self-leveling compound removal (greater than 3/4”)
   
   $_______ / LF

4. Crack Repair
   
   _____ 0.03 _____ LF $_______ / LF $_______

5a. Surface defect repair, including pop-outs, spalls, and gouges 3/4” – 1-1/2” DIA
   
   _____ 0.025 ____ UNITS $_______ / EA $_______

5b. Surface defect repair, including pop-outs, spalls, and gouges 1-1/2” – 3” DIA
   
   _____ 0.025 ____ UNITS $_______ / EA $_______

6. Surface embed repair, including cleanouts, in-floor electrical outlets and Walker Duct access holes.
   
   _____ 0.001 ____ UNITS $_______ / EA $_______

7. Large surface repair, existing underlayment removal and replacement with 1/4” Polished Overlay.
   
   $_______ / SF

8. Grout coat surface enhancement, including micro-pin holes, pitting and other shallow surface deficiencies
   
   _____ 0.10 _____ SF $_______ / SF $_______

9. Full Grind and Polish portions of the project not currently included.
   
   $_______ / SF
SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Concrete unit masonry.
B. Related Sections: The following sections contain requirements that relate to this Section:
   1. Division 7 Section "Flashing and Sheet Metal" for exposed sheet metal flashing installed in masonry.
C. Products installed but not furnished under this Section include the following:
   1. Steel lintels in unit masonry are specified in Division 5 Section "Metal Fabrications".

1.2 SUBMITTALS
A. Product data for each different masonry unit, accessory, and other manufactured product indicated.
B. Shop drawings for special unit masonry shapes in form of cutting and setting drawings showing sizes, profiles, and locations of each shape required.
E. Hot-weather construction procedures evidencing compliance with requirements specified in referenced unit masonry standard.
F. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Contracting Officer's and EXCHANGE, and other information specified.

1.3 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. 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.
C. 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.
1.4 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.

1.5 PROJECT CONDITIONS

C. 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.
4. Protect concrete unit masonry; protect concrete unit masonry of differing surface textures during installation; extra protection noted is for prevention of staining due to mortar droppings and cleaning of masonry.

D. Hot-Weather Construction: Comply with referenced unit masonry standard.

E. Following completion of unit masonry work, General Contractor shall be responsible to provide protection of in place work from damage by other trades.

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. Provide special shapes where indicated.
2. 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 or less than nominal widths by nominal heights by nominal lengths indicated on drawings and specifications.

3. Provide Type I, moisture-controlled units, integrally colored.

4. Exposed Faces: Manufacturer’s standard color and texture unless otherwise indicated.

B. Hollow Concrete Masonry Units: ASTM C90, Grade N and as follows:

1. Unit Compressive Strength: See general structural notes.

2. Weight Classification: Medium weight.

3. Integral Water Repellant: Provide units made with liquid polymeric, integral water-repellant admixture that does not reduce flexural bond strength. Units made with integral water repellant admixture, when tested as a wall assembly made with mortar containing integral water-repellant manufacturer’s mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of the test specimen.

   a. Products: Subject to compliance with requirements, provide one of the following:

      1) Block Plus W-10; Addiment, Inc.
      2) Dry-Block; WR Grace & Co.
      3) Rheopel; Master Builders

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.

C. Ready-Mixed Mortar: Cementitious materials, water, and aggregate complying with requirements specified in this article, combined with set-controlling admixtures to produce a ready-mixed mortar complying with ASTM C 1142.

D. Hydrated Lime: ASTM C 207, Type S.

E. Aggregate for Mortar: ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.


H. Water-Repellant Admixture: Liquid water-repellant mortar admixture intended for use with concrete masonry units, containing integral water-repellant by same manufacturer.

I. Water: Clean and potable.

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. Billet steel complying with ASTM A 615.
   2. Grade 60.
2.5 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.
   1. Wire Diameter: 0.1875 inch.
D. Galvanized Steel Sheet Thickness: As follows:
   1. 0.078 inch (14 gage).
E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.7 MISCELLANEOUS ANCHORS
A. Unit Type Masonry Inserts in Concrete: Cast iron or malleable iron inserts of type and size indicated.

2.8 POSTINSTALLED ANCHORS
A. Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing laboratory.
   1. Type: Expansion anchors.
   2. Corrosion Protection: Carbon steel components zinc plated to comply with ASTM B-633, Class Fe/Zn 5 for Class SC 1 service condition.

2.10 MISCELLANEOUS MASONRY ACCESSORIES
B. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.11 MASONRY CLEANERS
A. Job-Mixed Muriatic Solution: Solution of 1 part muriatic acid and 10 parts clean water, mixed in a nonmetallic container with acid added to water.
B. Job-Mixed Detergent Solution: Solution of trisodium phosphate (1/2-cup dry measure) and laundry detergent (1/2-cup dry measure) dissolved in one gallon of water.
C. Proprietary Acidic Cleaner: Manufacturer's standard-strength, general-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry units being cleaned:
   1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.
   2. For dark colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
4. Products: Subject to compliance with requirements, provide the following:
   

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.  
   2. Limit cementitious materials in mortar to Portland cement-lime.
B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification, for types of mortar indicated below:
   2. For exterior, non-loadbearing walls and parapet walls, and for other applications where another type is not indicated, use Type N.

2.14 MASONRY SEALER
A. Siloxane WB Concentrate, ProSoCo, Inc.
B. White Roc 10 WB, Sonneborn Building Products.
C. Enviroseal 7, Hydrozo, Inc.

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. 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 walls to the actual thickness shown, 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
C. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less that nominal 4-inch horizontal face dimensions at corners or jambs.
   1. See drawings for detail.

D. Stopping and Resuming Work: In each course, rack back 1/2-unit length for one-half 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.

E. Built-In Work: As construction progresses, build-in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Mortar Bedding: Lay units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place.

G. Jointing: Tool exposed joints slightly concave using a jointer larger than joint thickness, unless otherwise indicated.

H. Joining Existing Masonry: Tooth new masonry into existing masonry at all areas where new & existing brick abut.

3.5 CAVITIES/AIR SPACES

B. Tie exterior wythe to backup with individual metal ties. Stagger alternate courses.

3.6 HORIZONTAL JOINT REINFORCEMENT
A. General: Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls, ½ inch elsewhere. Lap reinforcing a minimum of 6 inches.

3.7 ANCHORING SINGLE-WYTHE MASONRY VENEER
A. Anchor single-wythe masonry veneer to metal studs with masonry veneer anchors to comply with the following requirements:
   1. Fasten each anchor section through sheathing to metal studs with 2 metal fasteners of type indicated.
   2. Embed tie section in masonry joints. Provide not less than 1-inch air space between back of masonry veneer wythe and face of sheathing.
   3. Locate anchor section relative to course in which tie section is embedded to allow maximum vertical differential movement of tie up and down.
   6. Install masonry reinforcing bars as shown on drawings.
7. Install No. 9 gauge horizontal joint reinforcement at all masonry veneer anchors.

3.9 LINTELS
   A. Install masonry lintels specified in the architectural and structural drawings.

3.10 FLASHING
   A. General: Install embedded flashing in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall, and where indicated.
   B. Prepare masonry surfaces so that they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive/sealant/tape as recommended by flashing manufacturer before covering with mortar.
   C. Install flashings as follows:
      1. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. Extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and through the inner wythe to within 1/2 inches of the interior face of the wall in exposed masonry. Where interior surface of inner wythe is concealed by furring, carry flashing completely through the inner wythe and turn up approximately 2 inches, unless otherwise indicated.
      2. At heads and sills, extend flashing as specified above unless otherwise indicated but turn up ends not less than 2 inches to form a pan.
      3. Install flashing in masonry veneer walls as specified above but carry flashing up face of sheathing at least 8 inches and behind air infiltration barrier/building paper.

3.11 REPAIRING, POINTING, AND CLEANING
   A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units and in fresh mortar or grout, pointed to eliminate evidence of replacement.
   B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints including corners, openings, and adjacent construction to provide a neat, uniform appearance, prepared for application of sealants.
      1. Provide tooled joint at brick masonry.
   C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
      1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
      2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Contracting Officer's approval of sample cleaning before proceeding with cleaning of masonry.
      3. Protect adjacent dissimilar masonry surfaces or precast concrete surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
      4. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
      5. Clean brick by means of bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised" using the following masonry cleaner:
         a. Job-mixed acidic solution.
         b. Job-mixed detergent solution.
         c. Proprietary acidic cleaner; apply in compliance with directions of acidic cleaner manufacturer.
D. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

E. IN PROGRESS PROTECTION: IN ADDITION TO ABOVE REQUIREMENTS, PROTECT ADJACENT DISSIMILAR MASONRY SURFACES OR PRECAST CONCRETE DURING MASONRY WORK OPERATIONS AND THROUGH COURSE OF JOB FROM DAMAGE. PROTECT AGAINST ALL POSSIBLE FORMS OF DAMAGE INCLUDING BUT NOT LIMITED TO CHIPPING, DISCOLORING, CRACKING, SCRATCHING, SPLATTER FROM ADJACENT MATERIAL, ETC. USE PROTECTION MEANS AS APPROPRIATE TO ASSURE THE ABOVE.

3.12 MASONRY SEALING

A. Applied per Manufacturer's recommendations.

END OF SECTION 04 20 00
SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel.

B. Related Sections:
   1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Division 09 painting Sections for surface-preparation and priming requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with applicable provisions of the following specifications and documents:
   1. AISC 303.
   2. AISC 341 and AISC 341s1.
   3. AISC 360.
   4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.5 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.6 MATERIALS

A. STRUCTURAL-STEEL MATERIALS

1. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.
2. Plate and Bar: ASTM A 36/A 36M.
3. Welding Electrodes: Comply with AWS requirements.

B. BOLTS, CONNECTORS, AND ANCHORS

1. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

C. PRIMER

1. Primer: SSPC-Paint 25, Type I, zinc oxide, alkyd, linseed oil primer.
2. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
3. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A 780.

1.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Mark and match-mark materials for field assembly.
2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning, SSPC-SP 2, "Hand Tool Cleaning, or SSPC-SP 3, "Power Tool Cleaning."

E. SHOP CONNECTIONS
2. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   a. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

F. SHOP PRIMING

1. Shop prime steel surfaces except the following:
   a. Surfaces to be field welded.
   b. Galvanized surfaces.

2. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   a. SSPC-SP 2, "Hand Tool Cleaning."

3. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   a. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   b. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

4. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

G. GALVANIZING

1. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   a. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.

1.8 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
4. Radiographic Inspection: ASTM E 94.

1.9 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

1.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

1.11 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 05 12 00
PART 1 - GENERAL

1.2 SUMMARY

A. This section includes the following metal fabrications:
   1. Miscellaneous steel trim.
   2. Rough hardware.

1.3 SUBMITTALS

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

C. Product data for products used in miscellaneous metal fabrications, including paint products and grout.

D. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.
   1. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.

E. Samples representative of materials and finished products as may be requested by Contracting Officer.

F. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

G. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Contracting Officer and AAFES, and other information specified.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Firms experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.

C. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel," D1.3 "Structural Welding Code - Sheet Steel", and D1.2 "Structural Welding Code - Aluminum."
   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
D. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated that have resulted in the successful installation of metal fabrications similar in material, design, and extent to that indicated for this Project.

1.5 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

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

C. Steel Bars for Gratings: ASTM A 569 or ASTM A 36.

D. Wire Rod for Grating Cross Bars: ASTM A 510.

E. Steel Tubing: Product type (manufacturing method) and as follows:
   1. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:
      a. Grade B, unless otherwise indicated or required for design loading.
      b. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

F. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:
   1. Cold-Rolled Steel Sheet: ASTM A 366.

H. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.

I. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.3 FASTENERS

A. Select fasteners for the type, grade, and class required.

2.4 PAINT

A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.
2.5 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 deg F (55.5 deg C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded
construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.7 MISCELLANEOUS STEEL TRIM

A. Provide shapes and sizes indicated for profiles shown. Unless otherwise indicated, fabricate units from structural steel shapes, plates, and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings, and anchorages as required for coordination of assembly and installation with other work.

2.12 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.
E. Field Welding: Comply with AWS Code 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. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.4 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION 05 50 00
SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   2. Plywood.

1.2 DEFINITIONS
A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified.

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

C. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
   1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
   2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
   3. For fire-retardant-treated wood products include certification by treating plant that treated material complies with specified standard and other requirements.
   4. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.

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 lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

   1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.
PART 2 - PRODUCTS

2.1 LUMBER, GENERAL

A. Lumber 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. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:

1. RIS - Redwood Inspection Service.
2. NLGA - National Lumber Grades Authority (Canadian).
3. SPIB - Southern Pine Inspection Bureau.
4. WCLIB - West Coast Lumber Inspection Bureau.
5. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction including cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. "No. 3 Common" or "Standard" grade boards per WCLIB or WWPA rules or "No. 2 Boards" per SPIB rules.

2.3 CONSTRUCTION PANELS

A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.

B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

C. Size and Grade: 4x8x5/8" APA A-C plugged exposure 1.
2.4 CONSTRUCTION PANELS FOR BACKING

A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.


E. Lag Bolts: ANSI B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.7 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

E. Fire-Retardant-Treated Plywood

1. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

2. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

   a. Use treatment that does not promote corrosion of metal fasteners.
   b. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   c. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F (76 deg C) shall be not less than span ratings specified.

3. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

4. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
5. Application: Treat all plywood unless otherwise indicated

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

E. Countersink nail heads on exposed carpentry work and fill holes.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size 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 of wood; predrill as required.

3.2 BLOCKING

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. 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. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

END OF SECTION 06 10 00
SECTION 06 40 23
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Solid Surfacing
   2. Hardwood Trim

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 5 Section “Metal Fabrications”.

1.3 QUALITY ASSURANCE
A. Fabricator Qualifications: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work.

B. Quality Standard: Except as otherwise indicated, comply with the following standard:

1.4 DELIVERY, STORAGE, AND HANDLING
A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.5 PROJECT CONDITIONS
A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction 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.

1.6 COORDINATION
A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

E. AWI Custom Grade; plain sawn, Grade II lumber.
   1. Hardwood species as indicated on Drawings

F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without a precoated finish.
   1. Products: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

A. Supply materials for installation of products as specified in manufacturer’s printed installation instructions including color matched silicon sealant and adhesives where applicable.

B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.

2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide interior woodwork complying with the referenced quality standard and of the following grade:
   1. Grade: Custom.

B. Fabricate woodwork to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

2.8 SHOP FINISHING

A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) for plumb and level (including tops).

C. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

END OF SECTION 06 40 23
SECTION 07 21 00
BUILDING INSULATION AND VAPOR RETARDER

PART 1 - GENERAL

1.2 SUMMARY
A. This Section includes the following:
   1. Building insulation in batt form.
B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 9 Section indicated below for sound attenuation insulation installed as part of metal-framed wall and partition assemblies.

1.3 DEFINITIONS
A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

1.4 SUBMITTALS
A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
B. Product data for each type of insulation product specified.
C. Product test reports from and based on tests performed by qualified independent testing laboratory evidencing compliance of insulation products with requirements including r-values (aged values for plastic foam insulations), fire performance characteristics, perm ratings, water absorption ratings, and other properties, based on comprehensive testing of current products.

1.5 DELIVERY, STORAGE, AND HANDLING
A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's recommendations for handling, storage, and protection during installation.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Manufacturers of Glass Fiber Insulation:
   a. CertainTeed Corp.
   b. Knauf Fiber Glass GmbH.
   c. Manville: Building Insulations Div., Manville Sales Corp.
   d. Owens/Corning Fiberglas Corp.

2.2 INSULATING MATERIALS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

B. Faced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type III, Class A (blankets with reflective vapor-retarder membrane facing with flame spread of 25 or less); foil-scrim-kraft or foil-scrim-polyethylene vapor-retarder membrane on one face, and as follows:

   1. Mineral Fiber Type: Fibers manufactured from glass.
   2. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively.
   3. Flanged Units: Provide blankets/batts fabricated with facing incorporating 4-inch-wide flanges along their edges for attachment to framing members.

C. Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

2.3 VAPOR RETARDERS

A. Polyethylene Vapor Retarder: ASTM D 4397, 6.0 mils thick, with a maximum permeance rating of 0.13 perms.

2.4 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation or mechanical anchors securely to substrates indicated without damaging or corroding either insulation, anchors, or substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present, for compliance with requirements of the Sections in which substrates and related work are specified and to determine if other conditions affecting
performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders.

3.3 INSTALLATION, GENERAL
A. Comply with insulation manufacturer’s instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer’s technical representative for specific recommendations before proceeding with installation of insulation.
B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION
A. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
B. Set vapor retarder faced units with vapor retarder to warm side of construction, except as otherwise indicated. Do not obstruct ventilation spaces, except for firestopping.
   1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
C. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
   1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping stapling flanges to flanges of metal studs.

3.6 INSTALLATION OF VAPOR RETARDERS
A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose fiber insulation.
B. Seal overlapping joints in vapor retarders with adhesives or tape per vapor retarder manufacturer’s printed directions. Seal butt joints and fastener penetrations with tape of type recommended by vapor retarder manufacturer. Locate all joints over framing members or other solid substrates.
C. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.
D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with tape of type recommended by vapor retarder manufacturer to create an airtight seal between penetrating objects and vapor retarder.

E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with tape or another layer of vapor retarder.

F. Provide strip of vapor retarder at exterior wall where interior wall framing intersects to maintain continuous vapor retarder envelope at all locations.

3.7 PROTECTION

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

END OF SECTION 07 21 00
SECTION 07 24 13
EXTERIOR INSULATION AND FINISH SYSTEMS - CLASS PB

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior insulation and finish system (EIFS) applied over the following:
   a. Gypsum sheathing.

B. Related Sections include the following:

1. Division 9 Section "Gypsum Board" for metal framing.

1.2 DEFINITIONS

A. EIFS: Exterior insulation and finish system(s).

B. Class PB EIFS: A "nonload bearing, exterior wall cladding system that consists of an insulation board attached either adhesively, mechanically, or both to the substrate; an integrally reinforced base coat; and a textured protective finish coat," as defined by ASTM C 1397.

1.3 PERFORMANCE REQUIREMENTS

A. EIFS Performance: Comply with the following:

1. Bond Integrity: Free from bond failure within EIFS components or between system and supporting wall construction, resulting from exposure to fire, wind loads, weather, or other in-service conditions.

2. Weather tightness: Resistant to water penetration from exterior into EIFS and assemblies behind it or through them into interior of building that results in deterioration of thermal-insulating effectiveness or other degradation of EIFS and assemblies behind it, including substrates, supporting wall construction, and interior finish.

B. Class PB EIFS: Provide EIFS having physical properties and structural performance that comply with the following when tested per methods referenced:

1. Abrasion Resistance: Sample consisting of 1-inch-(25.4-mm)- thick EIFS mounted on 1/2-inch-(12.7-mm)- thick gypsum board; cured for a minimum of 28 days; and showing no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested per ASTM D 968, Method A.

2. Accelerated Weathering Characteristics: Sample of size suitable for test equipment and consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 2000 hours when viewed under 5 times magnification per ASTM G 23, Method 1, or ASTM G 53.
3. Absorption-Freeze Resistance: No visible deleterious effects and negligible weight loss after 60 cycles per EIMA 101.01.
4. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate, cured for 28 days, and showing no growth when tested per ASTM D 3273.
5. Salt-Spray Resistance: Sample consisting of 1-inch (25.4-mm-) thick EIFS mounted on 1/2-inch (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 300 hours per ASTM B 117.
6. Tensile Adhesion: No failure in the adhesive, base coat, or finish coat. Minimum 5-psi (34.5 kPa) tensile strength before and after freeze-thaw and accelerated weathering tests per EIMA 101.03.
7. Water Penetration: Sample consisting of 1-inch (25.4-mm-) thick EIFS mounted on 1/2-inch (12.7-mm-) thick gypsum board, cured for 28 days, and showing no water penetration into the plane of the base coat to expanded polystyrene board interface of the test specimen after 15 minutes at 6.24 lbf/sq. ft. (299 Pa) of air pressure difference or 20 percent of positive design wind pressure, whichever is greater, across the specimen during a test period when tested per EIMA 101.02.
8. Water Resistance: Sample consisting of 1-inch (25.4-mm-) thick EIFS mounted on 1/2-inch (12.7-mm-) thick gypsum board; cured for 28 days; and showing no cracking, checking, crazing, erosion, rusting, blistering, peeling, or delamination after testing for 14 days per ASTM D 2247.
9. Impact Resistance: Sample consisting of 1-inch (25.4-mm-) thick EIFS when constructed, conditioned, and tested per EIMA 101.86; and meeting or exceeding the following impact classification and range:
   a. Standard Impact Resistance: 25 to 49 inch-lb (2.8 to 5.6 J).
10. Positive and Negative Wind-Load Performance: Sample assembly, 48 by 48 inches (1220 by 1220 mm) in size, consisting of studs, sheathing, and 1-inch (25.4-mm-) thick EIFS; and showing capability to withstand wind loads indicated when tested per ASTM E 330.

1.4 SUBMITTALS

A. Product Data: For each type and component of EIFS indicated.

B. Shop Drawings: For EIFS. Include plans, elevations, sections, details of components, details of penetration and termination, flashing details, joint locations and configurations, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.

C. Samples for Verification: 24-inch (600-mm-) square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including an aesthetic reveal and a typical control joint filled with sealant of color selected.

D. Manufacturer Certificates: Signed by manufacturers certifying that EIFS and joint sealants comply with requirements.

E. Compatibility and Adhesion Test Reports: For joint sealants from sealant manufacturer indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Maintenance Data: For EIFS to include in maintenance manuals.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

B. Source Limitations: Obtain EIFS through one source from a single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with system components.

C. Fire-Test-Response Characteristics: Provide EIFS and system components with the following fire-test-response characteristics as determined by testing identical EIFS and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting agency.


2. Full-Scale Fire Test: Tested mockup, in form indicated below, that represents completed wall assembly of which EIFS is a part, shows no tendency to propagate flame over the surface or through finish to core, or to cause delamination of finish when vertically mounted exterior face is exposed 15 minutes to a fire source using flame-spread test per ASTM E 108 modified for testing vertical walls as indicated below:

   a. Provide 2 panels, 72 by 120 inches (1830 by 3050 mm), consisting of protective finish coat and 2-inch- (51-mm-) thick insulation applied to 1/2-inch- (12.7-mm-) thick gypsum board; cured for 28 days; with protective finish coat removed to leave surface of insulation exposed on 1 panel in an area 4 inches (102 mm) high by 24 inches (610 mm) wide and centered 24 inches (610 mm) above bottom edge of panel.

3. Radiant Heat Exposure: No ignition of EIFS when tested according to NFPA 268.

4. Radiant Heat Exposure, Unrestricted Installation: Tolerable level of incident radiant heat energy of at least 12.5 kW/sq. m when tested according to the BOCA Code.

5. Surface-Burning Characteristics: Provide insulation board, adhesives, base coats, and finish coats with flame-spread index of 25 or less and smoke-developed index of 450 or less, per UBC Standard 8-1.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1. Stack insulation board flat and off the ground.
2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions
and ambient outdoor air and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions required for prefabricated panels by field measurements before fabrication and indicate measurements on Shop Drawings.

1.8 COORDINATION

A. Coordinate installation of EIFS with related Work specified in other Sections to ensure that wall assemblies, including sheathing, flashing, trim, joint sealants, windows, and doors, are protected against damage from the effects of weather, age, corrosion, moisture, and other causes. Do not allow water to penetrate behind flashing and protective coating of barrier EIFS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Class PB EIFS:
   a. Bonsal, W. R. Co.
   b. Dryvit Systems, Inc.
   c. Senergy Inc.; SKW-MBT Construction Chemicals.
   d. Shurcoat Wall Systems; VenTex, Inc.
   e. Stuc-O-Flex International, Inc.
   f. Texas EIFS, Teifs Wall Systems.

2.2 MATERIALS

A. Compatibility: Provide substrates, water-/weather-resistive barriers, adhesive, fasteners, board insulation, reinforcing meshes, base- and finish-coat systems, sealants, and accessories that are compatible with one another and approved for use by EIFS manufacturer for Project.

B. Colors,Textures, and Patterns of Finish Coat: Match Architects sample"

1. Color selected from manufacturer’s standard selection.

C. Exterior Gypsum Sheathing: Not less than ½-inch (12 mm) thick, gypsum sheathing complying with ASTM C 79 for exterior applications.

1. Fasteners: Wafer-head or hard-roc steel drill screws complying with ASTM C 954, with an organic-polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 500 hours per ASTM B 117.

   a. Size and Length: As recommended by sheathing manufacturer for type and thickness of sheathing board to be attached.

D. Water-/Weather-Resistive Barrier: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), without perforations.
   a. Sheathing Joint Compound and Tape: Type recommended by EIFS manufacturer for sealing joints between and penetrations through sheathing.

E. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to seal substrates from moisture penetration and to improve the bond between substrate of type indicated and adhesive used for application of insulation.

F. Flexible-Membrane Flashing: Cold-applied, fully self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.

G. Adhesive for Application of Insulation: EIFS manufacturer's standard formulation designed for indicated use, compatible with substrate, and complying with the following requirements:
   1. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.

H. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with EIFS manufacturer's requirements, ASTM C 578 for Type I, and EIMA's "EIMA Guideline Specification for Expanded Polystyrene (EPS) Insulation Board" for more stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
   1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks or by another method approved by EIMA that produces equivalent results.
   2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, per ASTM E 84.
   3. Dimensions: Provide insulation boards not more than 24 by 48 inches (610 by 1219 mm) and in thickness indicated but not more than 4 inches (102 mm) thick or less than thickness allowed by ASTM C 1397.

I. Reinforcing Mesh: Balanced, alkali-resistant, open-weave glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) per EIMA 105.01, complying with ASTM D 578 and the following requirements for minimum weight:
   1. Intermediate-Impact Reinforcing Mesh: Not less than 12.0 oz./sq. yd. (407 g/sq. m).
   2. Corner Reinforcing Mesh: Not less than 7.2 oz./sq. yd. (244 g/sq. m).

J. Base-Coat Materials: EIFS manufacturer's standard mixture complying with one of the following requirements for material composition and method of combining materials:
   1. Job-mixed formulation of portland cement complying with ASTM C 150, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use indicated.
   2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
   3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
   4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

K. Primer: EIFS manufacturer's standard factory-mixed elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
L. Finish-Coat Materials: EIFS manufacturer’s standard acrylic-based coating complying with the following requirements for material composition and method of combining materials:

1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.

M. Water: Potable.

N. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; selected for properties of pullout, tensile, and shear strength required to resist design loads of application indicated; capable of pulling fastener head below surface of insulation board; and of the following description:

1. For attachment to steel studs from 0.033 to 0.112 inch (0.84 to 2.84 mm) in thickness, provide steel drill screws complying with ASTM C 954.
2. For attachment to light-gage steel framing members not less than 0.0179 inch (0.45 mm) in thickness, provide steel drill screws complying with ASTM C 1002.
3. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C 1002, Type W.
4. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
5. For attachment, provide manufacturer's standard fasteners suitable for substrate.

2.3 ELASTOMERIC SEALANTS

A. Elastomeric Sealant Products: Provide EIFS manufacturer's listed and recommended chemically curing, elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials, and complies with requirements for products and testing indicated in EIMA's "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB" for products corresponding to description indicated below:

1. Low-modulus, multicomponent, nonsag urethane sealant.
2. Low-modulus, nonacid-curing silicone sealant.

B. Sealant Color: As selected by Architect from manufacturer's full range.

2.4 MIXING

A. General: Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of EIFS.
B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.

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

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.

B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.

C. Prepare and clean substrates to comply with EIFS manufacturer's written requirements to obtain optimum bond between substrate and adhesive for insulation.

D. Primer/Sealer: Apply over gypsum sheathing substrates to protect substrates from degradation and where required by EIFS manufacturer for improving adhesion of insulation to substrate.

E. Water-/Weather-Resistive-Barrier Coating: Apply over substrates to protect substrates from degradation and to provide water-/weather-resistive barrier.

1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing, unless otherwise indicated by EIFS manufacturer's written instructions.

F. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where indicated by EIFS manufacturer's written instructions to protect wall assembly from degradation. Prime substrates, if required, and install flashing to comply with EIFS manufacturer's written instructions and details.

3.3 EXTERIOR GYPSUM SHEATHING INSTALLATION

A. Water-/Weather-Resistive Barrier: Wrap into wall openings, such as for windows, doors, and mechanical equipment; lap with flashing to drain in the direction of flow. Extend continuously around corners and angles and behind control joints. Overlap upstanding vertical flashing/trim a minimum of 4 inches (100 mm) to shed water, unless otherwise indicated. Do not make holes, breaks, or tears in the barrier except by fasteners.

1. Asphalt-Saturated Organic Felt: Install a layer over exterior gypsum sheathing board and studs according to requirements of authorities having jurisdiction. Overlap to drain in the direction of flow. Apply horizontally with 2-inch (50-mm) overlap and 6-inch (150-mm) staggered end lap; fasten to sheathing with galvanized staples or roofing nails.

2. Kraft Waterproof Building Paper: Install a layer over exterior gypsum sheathing and studs according to manufacturer's written instructions and requirements of authorities having jurisdiction. Overlap to drain in the direction of flow.

B. Exterior Gypsum Sheathing: Install on metal framing to comply with gypsum sheathing manufacturer's written instructions and research/evaluation report acceptable to authorities having jurisdiction. Install board with steel drill screws spaced no more than 8 inches (203 mm) o.c. along framing with perimeter fasteners at least 3/8 inch (9.6 mm) but less than 5/8 inch (15.9 mm) from edges of boards.
3.4 EIFS INSTALLATION

A. General: Comply with ASTM C 1397 and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

B. Board Insulation: Adhesively and mechanically attach insulation to substrate in compliance with ASTM C 1397, EIFS manufacturer's written requirements, and the following:

1. Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of gypsum sheathing with adhesive once insulation is adhered to sheathing unless EIFS manufacturer's written instructions specify using primer/sealer with ribbon-and-dab method. Apply adhesive to a thickness of not less than 1/4 inch (6.4 mm) for factory mixed and not less than 3/8 inch (9.6 mm) for field mixed, measured from surface of insulation before placement.

2. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.

3. Allow adhered insulation to remain undisturbed for period recommended by EIFS manufacturer, but not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation, or applying base coat and reinforcing mesh.

4. Mechanically attach insulation to substrate by method complying with EIFS manufacturer's written requirements. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:

   a. Steel Framing: 5/16 inch (8 mm).

5. Apply insulation over dry substrates in courses with long edges of boards oriented horizontally.

6. Begin first course of insulation from a level base line and work upward.

7. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.

   a. Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.

   b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

8. Interlock ends at internal and external corners.

9. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.

10. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.

11. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm).

12. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).

13. Interrupt insulation for expansion joints where indicated.

14. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.

15. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches (64 mm) over front and back face, unless otherwise indicated on Drawings.

16. Treat exposed edges of insulation as follows:
a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.

17. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS protective coating lamina.

C. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. Where expansion joints are indicated in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction.

D. Base Coat: Apply to exposed surfaces of insulation in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.

E. Reinforcing Mesh: Embed type indicated below in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written requirements. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.

1. Intermediate-impact reinforcing mesh where indicated.

F. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.

1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.
2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application except without reinforcing mesh. Do not apply until first base coat has cured.

H. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.

I. Finish Coat: Apply over dry primer, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

3.5 INSTALLATION OF JOINT SEALANTS

A. Prepare joints and apply sealants, of type and at locations indicated, to comply with applicable requirements in Division 7 Section "Joint Sealants" and in EIMA’s "EIMA Guide for Use of Sealants with Exterior Insulation and Finish Systems, Class PB."

1. Clean surfaces to receive sealants to comply with indicated requirements and EIFS manufacturer's written instructions.
2. Apply primer recommended in writing by sealant manufacturer for surfaces to be sealed.
3. Install sealant backing to control depth and configuration of sealant joint and to prevent sealant from adhering to back of joint.
4. Apply masking tape to protect areas adjacent to sealant joints. Remove tape immediately after tooling joints, without disturbing joint seal.
5. Apply joint sealants after base coat has cured but before applying finish coat.

3.6 CLEANING AND PROTECTION

A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

B. Provide final protection and maintain conditions, in a manner acceptable to Installer and EIFS manufacturer, that ensure that EIFS are without damage or deterioration at time of Substantial Completion.

END OF SECTION 07 24 13
SECTION 07 72 00

ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof curbs.
   2. Equipment supports.

B. Related Sections:
   1. Division 07 Section "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   2. Division 23 Section "HVAC Power Ventilators" for power roof-mounted ventilators.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.
PART 2 - PRODUCTS

2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
   1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with
      ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply
      with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and
         fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.
   1. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with
      ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply
      with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and
         fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with
   temper to suit forming operations and performance required.
   1. Mill Finish: As manufactured.
   2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-
      colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2
      mil (0.005 mm).
   3. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to
      comply with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 620. System consisting of primer and
         fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and
   temper for type of use, finished to match assembly where used, otherwise mill finished.

E. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless
   otherwise indicated.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous
   items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, thickness as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use,
   acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with
   AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
E. Underlayment:
   1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   2. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.
   3. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
   2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
   3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
   4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.


2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. Custom Solution Roof and Metal Products.
   d. Greenheck Fan Corporation.
   e. LM Curbs.
   f. Metallic Products Corp.
   g. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   h. Pate Company (The).
   i. Roof Products, Inc.
   j. Safe Air of Illinois.
   k. Thybar Corporation.
   l. Vent Products Co., Inc.
B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Loads: Verify loads of actual equipment provided as indicated on Drawings.

D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (2.01 mm) thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As indicated on Drawings

E. Material: Aluminum sheet, 0.090 inch (2.28 mm) thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As indicated on Drawings.

F. Construction:
   1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
   2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
   3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
   4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
   6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
   7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. AES Industries, Inc.
   b. Curbs Plus, Inc.
   c. Custom Solution Roof and Metal Products.
   d. Greenheck Fan Corporation.
   e. LM Curbs.
   f. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
   g. Pate Company (The).
   h. Roof Products, Inc.
   i. Thybar Corporation.
   j. Vent Products Co., Inc.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Loads: Verify with equipment provided.
D. Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (2.01 mm) thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As indicated on Drawings.

E. Material: Aluminum sheet, 0.090 inch (2.28 mm) thick.
   1. Finish: Two-coat fluoropolymer.
   2. Color: As indicated on Drawings.

F. Construction:
   1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick cellulosic-fiber board insulation.
   2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
   3. Factory-installed continuous wood nailers 5-1/2 inches (140 mm) wide at tops of equipment supports.
   4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
   5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
   6. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
   7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.5 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted metal collar.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Custom Solution Roof and Metal Products.
      b. Thaler Metal USA Inc.
   2. Metal: Aluminum sheet, 0.063 inch (1.60 mm) thick.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions.

F. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Division 09 painting Sections.

C. Clean exposed surfaces according to manufacturer’s written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetrations in fire-resistance-rated walls.

1.2 ACTION SUBMITTALS

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

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:

1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:

a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
b. Classification markings on penetration firestopping correspond to designations listed by the following:

1) UL in its "Fire Resistance Directory."

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.6 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Grace Construction Products.
2. Hilti, Inc.
4. RectorSeal Corporation.
5. 3M Fire Protection Products.
7. USG Corporation.

2.2 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
1. Fire-resistance-rated walls include fire walls.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Temporary forming materials.
5. Steel sleeves.

2.3 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer’s written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer’s written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer’s recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or
damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections.

B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.
3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.7 PENETRATION FIRESTOPPING SCHEDULE

A. For each location where a fire-resistance-rated floor or wall assembly is penetrated, provide a UL-listed through-penetration firestop system selected from the applicable UL number range listed below that complies with requirements and is suitable for the penetration conditions indicated for the Project.

<table>
<thead>
<tr>
<th>Construction Conditions</th>
<th>Manufacturers</th>
<th>Product</th>
<th>Installation Spec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Metal pipe or conduit through framed walls</td>
<td>Metacaulk</td>
<td>950</td>
<td>WL 1026</td>
</tr>
<tr>
<td></td>
<td>Metacaulk</td>
<td>835</td>
<td>WL 1034</td>
</tr>
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<td></td>
<td>Bio Fireshield</td>
<td>Biostop 500</td>
<td>MP2GWB</td>
</tr>
<tr>
<td></td>
<td>3M</td>
<td>CP2SWB</td>
<td>UL System 147A</td>
</tr>
<tr>
<td>B. Metal pipe or conduit through concrete and masonry walls and floors</td>
<td>Metacaulk</td>
<td>950</td>
<td>CAJ 1035</td>
</tr>
<tr>
<td></td>
<td>Metacaulk</td>
<td>835</td>
<td>WJ1013</td>
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<tr>
<td></td>
<td>Bio Fireshield</td>
<td>100, 200</td>
<td>MP2 CNF</td>
</tr>
<tr>
<td></td>
<td>3M</td>
<td>CP2SWB</td>
<td>UL System 319</td>
</tr>
<tr>
<td>C. Insulated metal pipe through framed walls</td>
<td>Metacaulk</td>
<td>7000</td>
<td>WL 5057</td>
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<tr>
<td></td>
<td>Bio Fireshield</td>
<td>Biostop 500</td>
<td>IMP2GWB</td>
</tr>
<tr>
<td></td>
<td>3M</td>
<td>FS195</td>
<td>UL System 147</td>
</tr>
<tr>
<td></td>
<td>3M</td>
<td>CP25N/S</td>
<td>UL System 147</td>
</tr>
<tr>
<td>D. Insulated metal pipe through concrete and Masonry walls and floors</td>
<td>Metacaulk</td>
<td>1000</td>
<td>CAJ 5077</td>
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<td>Bio Fireshield</td>
<td>Biostop 500</td>
<td>IMP2CNF</td>
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<td></td>
<td>3M</td>
<td>See Mfg</td>
<td>UL System 91, 152,</td>
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<td>E. Plastic Pipe through framed walls</td>
<td>Metacaulk</td>
<td>1000</td>
<td>WL 2104</td>
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<td></td>
<td>Metacaulk</td>
<td>WRAPSTRIP</td>
<td>WL 2106</td>
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<td>Bio Fireshield</td>
<td>Biostop 500</td>
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<td>3M</td>
<td>FS195</td>
<td>UL System 148</td>
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<td>3M</td>
<td>CP25N/S</td>
<td>SP389</td>
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<td>Product</td>
<td>Installation Spec.</td>
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<td><strong>F. Plastic Pipe through concrete and masonry walls and floors</strong></td>
<td>Metacaulk</td>
<td>880</td>
<td>UL System 64</td>
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<td>Mfg Spec</td>
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<td>CS195</td>
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<tr>
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<td>3M</td>
<td>FS195</td>
<td></td>
</tr>
<tr>
<td><strong>G. Cable Tray through concrete and masonry walls and floors</strong></td>
<td>Metacaulk</td>
<td>Mortar</td>
<td>W7CI</td>
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<td>Biofireshield</td>
<td>Mortar</td>
<td>CBL36NW</td>
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<td>3M</td>
<td>CP25N/S</td>
<td>UL Sys. 105 or 66</td>
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<td><strong>(G2) Cable tray through Framed walls</strong></td>
<td>Metacaulk</td>
<td>Mortar</td>
<td>Appropriate UL system or Architectural System</td>
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<tr>
<td></td>
<td>Biofireshield</td>
<td>Mortar</td>
<td>Manufacturer Spec</td>
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<tr>
<td></td>
<td>3M</td>
<td></td>
<td>CS195</td>
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<tr>
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<td>UL System 557</td>
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<td><strong>(G3) Alternately, terminate cable tray prior to firewall designer modify</strong></td>
<td>Metacaulk</td>
<td></td>
<td>Appropriate UL system or Architectural Detail</td>
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<tr>
<td></td>
<td>Biofireshield</td>
<td></td>
<td>Manufacturers spec</td>
</tr>
<tr>
<td><strong>H. Telephone, fiber optic and other small miscellaneous conductors through Framed wall.</strong></td>
<td>Metacaulk</td>
<td>950</td>
<td>WL 8001</td>
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<td>Biofireshield</td>
<td>Biostop 500</td>
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<tr>
<td></td>
<td>3M</td>
<td>CP25N/S</td>
<td>UL System 149</td>
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</tbody>
</table>

* See UL Listing or Manufacturer’s Specifications for associated components not listed (i.e., sleeves, collars, mineral wool, etc.)

** Insulated cable, bus ducts, glass pipe, and other penetrations and construction conditions not listed above shall be firestopped with an approved UL system as defined by the Fire Resistance Directory.

END OF SECTION 07 84 13
SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following locations:

1. Interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:
   a. Control and expansion joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints of exterior openings where indicated.
   c. Tile control and expansion joints.
   d. Perimeter joints between interior wall surfaces and frames of interior doors.
   e. Perimeter joints of plumbing fixtures.
   f. Other joints as indicated.

2. Interior joints in horizontal traffic surfaces as indicated below:
   a. Control and expansion joints in cast-in-place concrete slabs.
   b. Other joints as indicated.

1.2 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.

1.3 SUBMITTALS

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

B. Product data from manufacturers for each joint sealant product required.

C. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.

D. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.

E. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

F. Product test reports for each type of joint sealants indicated, evidencing compliance with requirements specified.

1.4 QUALITY ASSURANCE

A. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.
1.5 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.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: 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 joint substrates are wet.

B. Joint Width Conditions: 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: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.7 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 Contracting Officer from manufacturer's full range of standard colors for products of type indicated.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants that comply with ASTM C 920 and other requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this Section, including those requirements referencing ASTM C 920 classifications for Type, Grade, Class, and Uses.

B. Interior joints in vertical surfaces and horizontal nontraffic surfaces:
   1. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for
sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.

C. Available Products: Subject to compliance with requirements, elastomeric sealants which may be incorporated in the Work included, but are not limited to, the following:

1. One-Part Nonsag Polysulfide Sealant:
   b. "PRC Rubber Caulk 7000" Product Research & Chemical Corp.
   c. "GC-9 Sythacalk"; Pecora Corp.

2. One-Part Mildew-Resistant Silicone Sealant:
   a. "Dow-Corning 786"; Dow Corning Corp.
   c. "863 #345 White"; Pecora Corp.
   d. "Rhodorsil 6B White"; Rhone-Poulenc Inc.
   e. "Proglaze White"; Tremco Corp.

3. Multi-Part Nonsag Urethane Sealant for Use NT:
   c. "Dynatrol II"; Pecora Corp.
   d. "Sonolastic NP 2"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.
   e. "Dymeric"; Tremco Inc.

4. Multi-Part, Pourable, Urethane Sealant for Use T:
   c. "NR-200 Urexpan"; Pecora Corp.
   e. "THC-900"; Tremco Inc.

2.3 LATEX JOINT SEALANTS

A. Interior joints in gypsum wall board and woodwork.

B. 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.

C. 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.

D. Silicone Emulsion Sealant: Provide product complying with ASTM C 834 and, except for weight loss measured per ASTM C 792, with ASTM C 920 that accommodates joint movement of not more than 25 percent in both extension and compression for a total of 50 percent.
E. Products: Subject to compliance with requirements, provide one of the following:

1. Acrylic-Emulsion Sealant:
   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. 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 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. 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. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. 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.

D. 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.
E. 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.
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following products manufactured in accordance with SDI Recommended Standards:

1. Doors: Seamless, hollow or composite construction standard steel doors for interior and exterior locations.
2. Frames: Pressed steel frames for doors, pocket doors, transoms, sidelights, mullions, interior glazed panels, and other interior and exterior openings of following type:
   a. Welded unit type.
3. Provide factory primed doors and frames to be field painted.

B. Painting primed doors and frames is specified in Division 9 Section "Painting."

C. Door hardware is specified in another Division 8 Section.

D. Glass and Glazing are specified in another Division 8 Section.

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 door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop drawings showing fabrication and installation of standard steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
   1. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
   2. Indicate coordinate of glazing frames and stops with glass and glazing requirements.

D. Samples for initial selection purposes in form of manufacturer's color charts showing full range of colors available for factory-finished doors and frames.
1.3 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications Standard Steel Doors and Frames" ANSI/SDI-100 and as herein specified.

B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Temperature-Rise Rating: Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Contracting Officer; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inches spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide standard steel doors and frames by one of the following:

1. Standard Steel Doors and Frames:
   a. Amweld Building Products, Inc.
   b. Ceco Corp.
   c. Copco Door Co.
   d. Curries Company.
   e. Deansteel Manufacturing Co.
   f. Fenestra Corp.
   g. Kewanee Corp.
   h. Mesker Door Co.
   i. Pioneer Industries.
   j. Premier Products, Inc. (Formerly Dittco).
   k. Republic Builders Products.
   l. Steelcraft Manufacturing Co.
2.2 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

B. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, or drawing quality, ASTM A 642, hot dipped galvanized in accordance with ASTM A 525, with A60 or G60 coating designation, mill phosphatized.

D. Supports and Anchors: Fabricate of not less than 18-gage sheet steel; galvanized where used with galvanized frames.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize in compliance with ASTM A 153, Class C or D as applicable.

F. Shop Applied Paint: Apply after fabrication.
   1. Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints complying with ANSI A224.1, "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames."

2.3 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide 1-3/4 inch (44.4 mm) thick doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless).

C. Exterior Doors: Provide 1-3/4 inch (44.4 mm) thick doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
   2. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.

2.4 FRAMES

A. General: Provide steel frames for doors, transoms, sidelights, relights and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.053-inch- (1.3-mm-) (16 gauge) thick steel sheet for:
   1. Door openings wider than 48 inches (1220 mm).
   2. Level 2 steel doors.

C. Frames of 0.075-inch- (14 gauge) thick steel sheet for:
   1. Level 3 steel doors.
D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

E. Plaster Guards: Provide 0.016-inch- (0.4-mm-) thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

F. Supports and Anchors: Fabricated from not less than 0.042-inch- (1.0-mm-) thick, electrolytic zinc-coated or metallic-coated steel sheet.
   1. Wall Anchors in Masonry Construction: 0.177-inch- (4.5-mm-) diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.

G. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with ANSI/SDI-100 requirements.
   1. Internal Construction: Manufacturer's standard honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards.
   2. Clearances: Not more than 1/8 inch at jambs and heads except between non-fire-rated pairs of doors not more than 1/4 inch. Not more than 3/4 inch at bottom.

B. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C236 or ASTM C 976 on fully operable door assemblies.
   1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.41 Btu/sq. ft. x h x deg F (2.33 W/sq. m x K) or better.

C. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel.

D. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

E. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel.

F. Fabricate exterior doors, panels, and frames from galvanized sheet steel in accordance with SDI-112. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.

G. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware in accordance with final Door Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Series Specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcing and provisions for fastening in top rail of doors or head of frames, as applicable.

I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at project site.

J. Locate hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware on Standard Steel Doors and Frames," published by Door and Hardware Institute.

K. Shop Painting: Clean, treat, and paint exposed surfaces of steel door and frame units, including galvanized surfaces.

1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
2. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

L. Glazing Stops: Minimum 20 gage steel.

1. Provide screw applied removable glazing beads on inside of glass, louvers, and other panels in doors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions For Steel Frames," unless otherwise indicated.

1. Except for frames located at existing concrete, masonry or drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In closed steel stud partitions, attach wall anchors to studs with screws.

C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100.

3.2 ADJUST AND CLEAN

A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
C. Final Adjustments: Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

END OF SECTION 08 11 13
SECTION 08 11 14
CUSTOM DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes custom-fabricated, commercial-quality steel doors and frames for doors and related openings, hollow metal panels, and louvers in these doors and frames.

B. Related Sections: The following sections contain requirements that relate to this Section:

2. Division 9 Section "Painting" for field painting of doors and frames.
3. Division 8 Section “Hollow Metal Doors and Frames”.

C. Products furnished but not installed under this Section include special doors and frames.

1.2 SUBMITTALS

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

B. Product Data: Manufacturer's specifications for fabrication and installation, including data substantiating that products comply with requirements.

C. Shop Drawings: For fabrication and installation of custom steel doors and frames work. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and reinforcements, and details of joints and connections.

1. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Contract Drawings.

1.3 QUALITY ASSURANCE

A. Provide custom doors and frames manufactured by a single firm specializing in the production of this type of work, unless otherwise acceptable to the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palleted, wrapped, or crated to provide protection during transit and job storage.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to the Contracting Officer; otherwise remove and replace damaged items as directed.

C. Store doors and frames at the building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid the use of nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.
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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Custom Doors and Frames:
   a. Eliason
   b. Frommelt
   c. Chase Industries

2.2 MATERIALS

A. Supports and Anchors: Fabricate of not less than 16-gage sheet metal. Galvanize after fabrication units to be built into exterior walls, complying with ASTM A 153, Class B.

B. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

C. Shop-Applied Paint: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.

2.3 DOORS

A. Provide one of the following:

   2. Frommelt Rigid Impact Traffic Doors, Model 3604.
   3. Chase Industries Core Doors, Model SC-3002.

B. Traffic doors shall be double-acting/self-closing type (using gravity-type hinges) of 3/4" thick solid-core construction, furnished complete with the following:

   1. Vision panels of acrylic plastic.
   2. Laminated plastic cladding on all exposed door surfaces.
   3. Minimum 18 gauge, 30" high stainless steel impact panels both sides of door.

2.4 FABRICATION, GENERAL

B. Shop Painting: Clean, treat, and paint exposed surfaces of steel doors and frames, including galvanized surfaces, but excluding stainless steel surfaces.

   1. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.
   2. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT2), hot phosphate solution (SSPC-PT4), or basic zinc chromate-vinyl butyryl solution (SSPC-PT3).
   3. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Frames: Provide custom steel frames for doors, transoms, side lights, borrowed lights, and other openings, of size and profile as indicated.

1. Install frames and accessories in accordance with shop drawings, manufacturer's data, and as herein specified.
2. Placing Frames: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   a. Make field splices in frames as detailed on final shop drawings, welded and finished to match factory work.
   b. Remove spreader bars only after frames or bucks have been properly set and secured.

B. Door: Fit non-fire-rated doors accurately in their respective frames.

3.2 ADJUST AND CLEAN

A. Final Adjustments: Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.

B. Prime Coat Touch-Up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

C. Stainless Steel Touch-Up: Immediately after erection, smooth any abraded areas of stainless steel and polish to match undamaged finish.

END OF SECTION 08 11 14
SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory machining for hardware.

B. Related Sections include the following:

1. Division 8 Section "Hollow Metal Steel Doors and Frames" for metal door frames.
2. Division 8 Section "Door Hardware".

1.2 SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. LEED Submittals:

1. Certificates for Credit MR 6 Credit MR 7: Chain-of-custody certificates indicating that flush wood doors comply with forest certification requirements. Include documentation that manufacturer is certified for chain of custody by an FSC-accredited certification body. Include statement indicating cost for each certified wood product.
2. Product Data for Credit IEQ 4.4: For adhesives and composite wood products, documentation indicating that product contains no urea formaldehyde.
3. Laboratory Test Reports for Credit IEQ 4: For adhesives composite wood products and paints and coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services 'Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.

D. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated." Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect doors during transit, storage and handling to prevent damage, soiling, warping and deterioration. Protect doors from direct sunlight. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting. Separate packing materials in accordance with Waste Management Plan and place in designated areas for recycling.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. General Warranty: Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
B. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect from date of Substantial Completion for the life of the installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Flush Wood Doors:
   a. Algoma Hardwoods Inc.
   b. Eggers Industries; Architectural Door Division.
   c. GRAHAM Manufacturing Corp.
   d. Haley Brothers, Inc.
   e. Lynden Door, Inc.
   f. Vancouver Door Company, Inc.
   g. VT Industries Inc.
   h. Weyerhaeuser Company.
   i. Western Oregon Door, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:

1. Grade: Premium, with Grade A faces.
2. Species and Cut: Red oak, plain sliced.
4. Assembly of Veneer Leaves on Door Faces: Balance match.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

2. Blocking: Provide wood blocking in particleboard-core doors as follows:
   a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
   b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have kick, mop, or armor plates.
   c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
B. Interior Veneer-Faced Doors:
   1. Core: Particleboard.
   2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
   1. Comply with clearance requirements of referenced quality standard for fitting.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
   1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

2.5 FACTORY FINISHING

A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.

B. Finish doors at factory.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI System TR-6 catalyzed polyurethane.
   3. Effect: Open-grain finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

A. Hardware: For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

E. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

   a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

3. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

C. Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 14 16
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes electrically operated overhead coiling grilles.
B. Related Sections include the following:
   1. Division 26 Section "Conductors and Cables" for electrical service and connections for powered operators, and accessories.
   2. Division 26 Section "Disconnect Switches and Circuit Breakers" for disconnect switches and circuit breakers for powered operators.

1.2 DEFINITIONS
A. Operation Cycle: One complete cycle of a grille begins with the grille in the closed position. The grille is then moved to the open position and back to the closed position.

1.3 PERFORMANCE REQUIREMENTS
A. Operation-Cycle Requirements: Design overhead coiling grille components and operator to operate for not less than 20,000 cycles.
B. Seismic Performance: Overhead coiling grilles shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   2. Seismic Component Importance Factor: 1.0.

1.4 SUBMITTALS
A. Product Data: For each type and size of overhead coiling grille and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
   1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
   2. Summary of forces and loads on walls and jambs.
   3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by grille manufacturer and those provided by others.
C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling grille manufacturer for both installation and maintenance of units required for this Project.

B. Source Limitations: Obtain overhead coiling grilles through one source from a single manufacturer.

   1. Obtain operators and controls from the overhead coiling grille manufacturer.

C. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.

   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

   1. Alpine Overhead Doors, Inc.
   2. Atlas Door Corp.; Div. of Clopay Building Products Co.
   3. The Cookson Company.
   6. Mahon Door Corp.
   7. McKeon Rolling Steel Door Company, Inc.
   8. Metro Door.
   10. Pacific Rolling Door Co.
   12. Wayne-Dalton Corp.
   13. Windsor Door; A United Dominion Company.

2.2 OVERHEAD COILING GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. General: Fabricate overhead coiling grille curtain consisting of a network of 5/16-inch (8-mm) minimum diameter horizontal rods, or rods covered with tube spacers, spaced as indicated. Interconnect rods by vertical links approximately 5/8 inch (16 mm) wide, spaced as indicated and rotating on rods.

   1. Space rods at approximately 2 inches (51 mm) o.c.
   2. Space links in line at approximately 9 inches (228 mm) apart.
   3. Aluminum Grilles: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Endlocks: Continuous end links, chains, or other devices at ends of rods, locking and retaining grille curtain in guides against excessive pressures, maintaining curtain alignment, and preventing lateral movement.

C. Bottom Bar: Manufacturer's standard continuous channel, tubular shape, or 2 angles, finished to match grille.

   1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene, between angles or fitted to shape, as a cushion bumper for interior grille.
   2. Provide motor-operated grilles with combination bottom astragal and sensor edge.
D. Curtain Jamb Guides: Manufacturer's standard extruded-aluminum shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel. Provide removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

A. Push/Pull Handles: For push-up-operated or emergency-operated grilles, provide lifting handles on each side of grille.

B. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
   1. Locking Bars: Single-jamb side, operable from inside and outside.
   2. Provide electric interlock to prevent operation when locks are engaged in tracks.

C. Where grille unit is power operated, provide safety interlock switch to disengage power supply when grille is locked.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance grille by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to the curtain. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of curtain and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

D. Fabricate torsion rod for counterbalance shaft of case-hardened steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate.

2.5 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

2.7 ELECTRIC GRILLE OPERATORS

A. General: Provide electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operational life specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

B. Comply with NFPA 70.

C. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

D. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

E. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

F. Grille-Operator Type: Provide wall-, hood-, or bracket-mounted, jackshaft, gear-head hoist-type grille operator unit consisting of electric motor, enclosed worm-gear running-in-oil primary drive, chain and sprocket secondary drive, and auxiliary chain hoist and floor level disconnect.

G. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate grille in either direction, from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (0.3 m/s), without exceeding nameplate ratings or considering service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
5. Provide 208V three phase motor.

H. Remote-Control Station: Provide momentary-contact, key switch with key position indicators for open, close and stop.

1. Provide interior and exterior units, recessed, heavy-duty type. Grill needs to be operable from either inside or outside the store.

I. Obstruction Detection Device: Provide each motorized grille with indicated external automatic safety sensor able to protect full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.
1. Sensor Edge: Provide each motorized grille with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward grille travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
   a. Provide electrically actuated automatic bottom bar.
      1) Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

J. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

K. Emergency Egress Release: Provide grille with flush, wall-mounted handle mechanism, for ADA-compliant egress feature, not dependent on electric power, which allows grille to open to permit passage and automatically resets motor drive, without affecting limit switches, with return of handle to original position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install grilles and operating equipment complete with necessary hardware, according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

A. Lubricate bearings and sliding parts; adjust grilles to operate easily, free from warp, twist, or distortion and fitting tight for entire perimeter.

3.3 EXCESS MATERIALS AND WASTE

A. Recycling: Separate and recycle all waste materials in accordance with the Contractor's waste management plan and to the extent economically feasible. This includes metal banding, pallets, and other shipping materials in addition to waste resulting from installation operations.

3.4 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train AAFES' maintenance personnel as specified below.
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Train AAFES' maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
   3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
   4. Schedule training with AAFES with at least 7 days' advance notice.

END OF SECTION 08 33 26
SECTION 08 41 13
ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Exterior and interior storefront systems.

B. Related sections include the following:

1. Division 7 Section "Joint Sealants" for joint sealants installed as part of aluminum entrance and storefront systems.
2. Division 8 Section "Hardware" for Door Hardware.
4. Division 8 Section "Glazing" for glass and glazing.

1.2 SYSTEM DESCRIPTION

A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:

1. Air infiltration and water penetration exceeding specified limits.
2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.

B. Force Protection: System must comply with UFC 4-010-01, part B-3.1.2.

C. Glazing: Physically and thermally isolate glazing from framing members.

D. Thermally Broken Construction: Provide systems that isolate aluminum exposed to exterior from aluminum exposed to interior with a material of low thermal conductance.

E. Wind Loads: Provide storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.

1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19 mm), whichever is smaller, unless otherwise indicated.
2. Static-Pressure Test Performance: Provide storefront systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.

a. Test Pressure: 150 percent of inward and outward wind-load design pressures.
b. Duration: As required by design wind velocity; fastest 1 mile (1.609 km) of wind for relevant exposure category.
F. Seismic Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction or ASCE 7, "Minimum Design Loads for Buildings and Other Structures," Section 9, "Earthquake Loads," whichever are more stringent.

G. Dead Loads: Provide entrance- and storefront-system members that do not deflect an amount which will reduce glazing bite below 75 percent of design dimension when carrying full dead load.

1. Provide a minimum 1/8-inch (3.18-mm) clearance between members and top of glazing or other fixed part immediately below.
2. Provide a minimum 1/16-inch (1.59-mm) clearance between members and operable windows and doors.

H. Live Loads: Provide entrance and storefront systems, including anchorage, that accommodate the supporting structures' deflection from uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

1. Frames, mullions and window hardware must resist a static load of 7 kilopascals (1 lb. per sq. in.) applied to the surface of the glazing. Frame and mullion deformations shall not exceed 1/160 of the unsupported member lengths.
2. Provide a minimum frame height of 25 mm (1-in). Design frame connections to surrounding walls to resist a combined ultimate loading of a tension force of 35 kN/m (200lbs-in.) and a shear force of 13 kN/m (75lbs-in.).

I. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. (0.3 L/s/sq. m) of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft. (75.2 Pa).

J. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than 6.24 lbf/sq. ft. (299 Pa). Water leakage is defined as follows:

1. Uncontrolled water infiltrating systems or appearing on systems' normally exposed interior surfaces from sources other than condensation. Water controlled by flashing and gutters that is drained back to the exterior and cannot damage adjacent materials or finishes is not water leakage.

K. Thermal Movements: Provide entrance and storefront systems, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, damaging stresses on glazing, failure of joint sealants, damaging loads on fasteners, failure of doors or other operating units to function properly, and other detrimental effects.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

L. Structural-Support Movement: Provide entrance and storefront systems that accommodate structural movements including, but not limited to, sway and deflection.

M. Condensation Resistance: Provide storefront systems with condensation resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.1.

N. Average Thermal Conductance: Provide storefront systems with average U-values of not more than 0.63 Btu/sq. ft. x h x deg F (3.57 W/sq. m x K) when tested according to AAMA 1503.1.
O. Dimensional Tolerances: Provide entrance and storefront systems that accommodate dimensional tolerances of building frame and other adjacent construction.

1.3 SUBMITTALS

A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.

B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.

   1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.
   2. Details for construction and attachment demonstrating compliance with UFC requirements.

D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

E. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include joint sealant manufacturers' written interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.

F. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of entrance and storefront systems with requirements based on comprehensive testing of current systems.

G. Samples for Verification Purposes: 6” long, sample of frame material showing cross-section, thermal break construction and color.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of entrance and storefront systems and are based on the specific systems indicated. Other manufacturers' systems with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

   1. Do not modify intended aesthetic effect, as judged solely by Contracting Officer, except with Contracting Officer's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Contracting Officer for review.


1.5 PROJECT CONDITIONS
A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Butler Manufacturing Company; Vistawall Architectural Products.
2. EFCO Corporation.
5. YKK AP America Inc.
6. Arcadia
7. Capitol Aluminum and Glass Corporation.
8. Old Castle Building Envelope.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.

5. Welding Rods and Bare Electrodes: AWS A5.10.

B. Steel Reinforcement: Complying with ASTM A 36 (ASTM A 36M) for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 (ASTM A 570M) for hot-rolled sheet and strip.

C. Glazing as specified in Division 8 Section "Glazing."

D. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.

E. Secondary Sealant: For use as weatherseal, compatible with structural silicone sealant and other system components with which it comes in contact, and that accommodates a 50 percent increase or decrease in joint width at the time of application when measured according to ASTM C 719.

2. Use neutral-cure silicone sealant with insulating-glass units.

F. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

G. Sealants and joint fillers for joints at perimeter of storefront systems as specified in Division 7 Section "Joint Sealants."
H. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.3 COMPONENTS

A. Framing: 2" x 4-1/2" nominal dimension, thermally broken; flush glazing stops; internal weep drainage, glazed to outside face of frame.

B. Doors: Provide manufacturer’s standard 1-3/4-inch- (44.5-mm-) thick glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
   1. Glazing stops and Gaskets: Provide manufacturer’s standard snap-on extruded-aluminum glazing stops and preformed gaskets, non-removable at exterior.
   2. Stile Design: Medium stile; 5 inch (127 mm) nominal width.
   3. Reinforce doors for automatic swing operation as specified in Door Hardware Section 08 71 00.
   4. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
   5. Glass to be 1” clear insulated tempered glass.

C. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Reinforce members as required to retain fastener threads.
   2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.

E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

F. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing, compatible with adjacent materials, and of type recommended by manufacturer.

G. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:
   1. Compression Weather Stripping: Molded neoprene complying with ASTM D 2000 requirements or molded PVC complying with ASTM D 2287 requirements.
   2. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.4 HARDWARE

A. See Section 08 71 00 Door Hardware.

2.5 FABRICATION

A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
1. Fabricate components for screw-spline frame construction.

B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.

C. Prepare components to receive concealed fasteners and anchor and connection devices.

D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."

H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.

J. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill and tap for factory-installed hardware before finishing components.

1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. Reinforce for automatic swing operators as specified in Section 08 71 00.

2.6 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Class I, Clear Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: Nonspecular as fabricated; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, or electrolytically deposited coating 0.018 mm or thicker) complying with AAMA 606.1 or AAMA 608.1.

1. Color: Dark Bronze.
2.7 STEEL PRIMING

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.

B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.

D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."

E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.

F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.

   1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.

G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.

H. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.
I. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

J. Erection Tolerances: Install storefront systems to comply with the following maximum tolerances:

1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation and weathertight closure.

B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08 41 13
SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

1.2 RELATED SECTIONS

A. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section "Hollow Metal Steel Doors and Frames" for hardware used with hollow metal frames.

1.4 REFERENCES

A. AWI (Architectural Woodwork Institute) – Architectural Woodwork Quality Standards
B. BHMA (Builders Hardware Manufacturers Association)
C. DHI (Door and Hardware Institute)
D. NFPA 80 – Fire Doors and Windows
F. NFPA 252 – Fire Tests of Door Assemblies
G. UL 10B – Safety Fire Tests of Door Assemblies

1.5 SUBMITTALS FOR REVIEW

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

1. Final Hardware Schedule Content: Based on hardware indicated, organize schedule into "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

   a. Type, style, function, size, and finish of each hardware item.
   b. Name and manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each hardware set cross referenced to indications on Drawings both on floor plans and in door and frame schedule.
   e. Explanation of all abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for hardware.
   g. Door and frame sizes and materials.
1.6 SUBMITTALS AT PROJECT CLOSEOUT

A. Maintenance Data: Include data on operating hardware, lubrication requirements and inspection procedures related to preventative maintenance.

B. Keys: Deliver with identifying tags to local facility EXCHANGE General Manager by security shipment direct from hardware supplier.

1.7 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

B. Supplier Qualifications: A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced architectural hardware consultant (AHC) who is available to Owner, Architect, and Contractor, at reasonable times during the course of the Work, for consultation.

C. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels. If automatic self-latching bolts, coordinators, and astragals are required they shall be furnished.

D. Submit fire test data showing compliance with UBC Std. 7-2 and supplemental “S” label requirements.

E. Hardware: Coordinate products used during fire tests meeting UBC 7-2 and ICBO AC84, including component gasket system for “S” labeled openings. All hardware must provide an acceptable means of egress to the Building Official.

1.8 PRODUCT HANDLING

A. Tag each item, or package separately, with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Deliver all hardware to the General Contractor in a timely manner to ensure orderly progress of the total work.

C. The General Contractor shall receive, take charge of, and distribute hardware at the building. General Contractor shall provide and arrange temporary shelving for the storage of all hardware.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Submittals for approved substitutions must be received no later than 10 days before bid date. Only requests for substitutions submitted by a distributor firm will be considered. No substitutions will be allowed after bid opening.
1. Hinges: Unless otherwise noted provide 5-knuckle, button tip, full mortise template type butts with non-rising pins, plain or ball-bearing as indicated. Provide non-removable pins for all out-swinging doors with locksets.
   a. Bommer Industries, Inc.
   b. Hager Hinge Co.
   c. Ives, Div. Ingersoll-Rand
   d. McKinney Products Co.
   e. Stanley Hardware, Div. Stanley Works.

2. Key Control System:
   a. Key Control Systems, Inc.
   b. Telkee Inc.

3. Locks: Locks and latches shall be full mortise type 1000, grade 1, in accordance with BHMA/ANSI A156.13 All locks shall be have interchangeable cores. All cylinders shall be provided with temporary construction cores.
   a. Best Access Systems
   b. Falcon Lock, Div. Ingersoll-Rand Door Hardware Group
   c. Arrow Lock, Div. Assa Abloy Group

4. Cipher Locks:
   a. Kaba-Simplex

5. Cylinders:
   a. Best Access Systems
   b. Falcon Lock, Div. Ingersoll-Rand Door Hardware Group
   c. Arrow Lock, Div. Assa Abloy Group

6. Bolts:
   a. Triangle Brass Manufacturing Company (Trimco)
   b. Ives, Div. Ingersoll-Rand Door Hardware Group
   c. Rockwood Mfg. Company

7. Overhead Closers / Auto. Operators:
   a. LCN Closers, Div. Ingersoll-Rand Door Hardware Group
   b. Norton Door Closers, Div. Yale Security Group
8. Door Control Devices:
   a. Rockwood Mfg. Company
   b. Ives, Div. Ingersoll-Rand Door Hardware Group
   c. Triangle Brass Manufacturing Company (Trimco).

9. Door Trim Units:
   a. Rockwood Mfg. Company
   b. Ives, Div. Ingersoll-Rand Door Hardware Group
   c. Triangle Brass Manufacturing Company (Trimco).

10. Kick, Mop, and Armor Plates:
    a. Rockwood Mfg. Company
    b. Ives, Div. Ingersoll-Rand Door Hardware Group
    c. Triangle Brass Manufacturing Company (Trimco).

11. Door Stripping and Seals:
    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co., Inc.
    c. Reese Enterprises, Inc.

12. Thresholds:
    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co., Inc.
    c. Reese Enterprises, Inc.

13. Automatic Drop Seals:
    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co., Inc.
    c. Reese Enterprises, Inc.

14. Astragals:
    a. National Guard Products, Inc.
    b. Pemko Manufacturing Co., Inc.
    c. Reese Enterprises, Inc.

15. Exit Devices: Exit devices shall be modern style ANSI A156.3 grade 1.
    a. Von Duprin, Div. Ingersoll-Rand Hardware Group
    b. Sargent, Div. Assa Abloy
    c. Precision Hardware, Inc.
2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Butts and Hinges: Stanley Hardware
2. Locks: Best Access Systems unless otherwise specified
3. Exit/Panic Devices: Von Duprin, Div Ingersoll-Rand Hardware Group
5. Overhead Closers: LCN Closers, Div Ingersoll-Rand Hardware Group
6. Door Controls: Glynn-Johnson, Div Ingersoll-Rand Hardware Group
7. Door Controls: Ives, Div Ingersoll-Rand Hardware Group
8. Door Stripping and Seals: Pemko Manufacturing Co., Inc.
10. Bolts: Ives, Div Ingersoll-Rand Hardware Group
11. Exit Alarms: Detex Corporation
12. Door Viewers: Du Seung Trading Corporation

2.3 LOCK CYLINDERS AND KEYING

A. All cylinders shall be keyed as directed by Owner, integrated into Grandmaster key system.

B. All cylinders shall be factory keyed and masterkeyed as directed.

2.4 ELECTRONIC HARDWARE

A. Provide a complete description of how each electronic hardware system should function.

B. Provide complete wiring diagrams, riser drawings and installation instructions for each system.

2.5 HARDWARE SETS

A. Hardware sets indicate quantity, item, manufacturer and product designation, size, and finish or color, as applicable.

Hardware – 102A, 102B, 401A
All Hardware by Door Manufacturer. Refer to Section 081114.

Hardware – 201A, 202A
1 Each Cylinder 1E72/1E74 US26D As Required
All Other Hardware by Door Manufacturer
Hardware – 118A

3 Each Hinges FBB179 4.5 x 4.5 US26D NRP
1 Each Lock 45H7D15H US26D
1 Each Wall Stop WS402CCV US26D
1 Each Kickplate 10” x 2” LDW US32D
3 Each Silencer SR64

PART 3 - EXECUTION

3.1 INSTALLATION:

Mount hardware units at heights indicated in Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division-9 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

Drill and counter sink units which are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

3.2 ADJUST AND CLEAN:

Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustments of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilation equipment.

Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finish during the final adjustment of hardware.

Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials, or installation of hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

END SECTION 08 71 00
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes glazing for the following products, including those specified in other Sections where glazing requirements are specified by reference to this Section:

2. Vision Lites.

1.2 DEFINITIONS
A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

1.3 PERFORMANCE REQUIREMENTS
A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.4 SUBMITTALS
A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

C. Product data for each glass product and glazing material indicated.

D. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.

1. Separate certifications are not required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

E. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

1.5 QUALITY ASSURANCE
A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGMA Publications: "FGMA Glazing Manual."
2. LSGA Publications: "LSGA Design Guide."

1. Provide safety glazing at locations required in the 2003 IBC Section 2406.

D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

E. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:

1. Primary glass of each (ASTM C 1036) type and class indicated.

F. Single-Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.


1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 PROJECT CONDITIONS

A. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

B. Install liquid sealants at ambient and substrate temperatures above 40 deg F (4.4 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, glass products as manufactured by one of the following companies may be used.

1. AFG Industries, Inc.
2. Saint-Gobain.
3. Ford Glass Division.
4. LOF Glass, Inc.
5. Guardian Industries Corp.
6. PPG Industries, Inc.

2.2 PRIMARY FLOAT GLASS PRODUCTS

A. Float Glass (Symbol "F"): ASTM C 1036, Type I (transparent glass, flat), Class 1 (clear) float glass, and Quality q3 (glazing select).
B. Assembled Units: Refer to requirements for sealed insulating glass units for performance characteristics of assembled units relative to visible light transmittance, U-values, shading coefficient, and visible reflectance.

2.3 HEAT-TREATED FLOAT GLASS PRODUCTS, GENERAL

A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.

2.4 HEAT-TREATED FLOAT GLASS

A. Uncoated, Clear, Heat-Treated Float Glass (Symbol "T"): ASTM C 1048, Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), kind FT (fully tempered).

1. ¼" thick.

B. Accessories:

1. Slotted Hardware: Garcy No. 1747.

2.5 ELASTOMERIC GLAZING SEALANTS

A. General: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation:

1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
2. Colors: Provide color of exposed joint sealants to match adjacent surfaces to be sealed. Refer uncertain areas to Contracting Officer; colors will be will selected from manufacturer's full range of standard colors.

B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants that comply with ASTM C 920 requirements for Type, Grade, Class and Uses suitable for conditions shown and as recommended by manufacturer.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, nonstaining and nonmigrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800 for product type provided.

B. Expanded Cellular Glazing Tape: Closed-cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.

2.7 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. EPDM, ASTM C 864.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

2.9 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:
1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact
   glass with metal framing. Use suction cups to shift glass units within openings; do not raise or
   drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so
   edges are located at top of opening, unless otherwise indicated by manufacturer's label.
2. Remove damaged glass from Project site and legally dispose of off site. Damaged glass is glass
   with edge damage or other imperfections that, when installed, weaken glass and impair
   performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by
   preconstruction sealant-substrate testing.
E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing
   standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible
   sealant suitable for heel bead.
F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
   1. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing
      to preserve required face clearances, except where gaskets and glazing tapes are used that have
      demonstrated ability to maintain required face clearances and comply with system performance
      requirements.
   2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width.
      With glazing tape, use thickness slightly less than final compressed thickness of tape.
H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise
   required by glass manufacturer.
I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING
A. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or
   protrude slightly above sightline of stops.
B. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit
   opening.
C. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to
   jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to
   heads and sills.
D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints
   in tapes with compatible sealant approved by tape manufacturer.
E. Do not remove release paper from tape until just before each lite is installed.
F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense
   compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket
   applications at corners and work toward centers of openings.
G. Apply cap bead of elastomeric sealant over exposed edge of tape.
3.5 SEALANT GLAZING (WET)

A. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

3.6 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than 4 days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.7 GLASS SCHEDULE

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>TYPE</th>
<th>LOCATION (Where indicated and: )</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Float Glass</td>
<td>Typical interior except where otherwise noted</td>
</tr>
<tr>
<td></td>
<td>¼” Clear</td>
<td></td>
</tr>
<tr>
<td>T/L</td>
<td>Safety Glass</td>
<td>Interior doors &amp; where required by IBC 2406 and at shelving.</td>
</tr>
<tr>
<td></td>
<td>¼” Clear</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION 08 80 00
SECTION 09 22 16
NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

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

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: As indicated or required by conditions of installation.

E. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch- (12.7-mm-) wide flanges, 3/4 inch (19.1 mm) deep.
   2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22.2 mm) deep.
      a. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
3. Resilient Furring Channels: 1/2-inch-(12.7-mm-) deep members designed to reduce sound transmission.
   a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Products: Subject to compliance with requirements, provide one of the following:
      b. Chicago Metallic Corporation; 660-C Drywall Furring System.
      c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.027 inch (0.7 mm), 0.0312 inch (0.79 mm) for framing supporting ceramic tile substrates.
   2. Depth: As indicated or required by conditions of installation.

B. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-(50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-(50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
         1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
         2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base Metal Thickness: 0.0179 inch (0.45 mm).
   2. Depth: 7/8 inch (22.2 mm).

E. Cold-Rolled Furring Channels: 0.0538-inch (1.37-mm) bare-steel thickness, with minimum 1/2-inch-(12.7-mm-) wide flanges.
1. Depth: 3/4 inch (19.1 mm).
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch (0.79 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- (1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

F. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (31.8 mm), wall attachment flange of 7/8 inch (22.2 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.
   1. Space studs as follows:
      a. Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
   a. Install two studs at each jamb, unless otherwise indicated.
   b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
   c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

D. Direct Furring:
   1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

E. Z-Furring Members:
   1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
   2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
   3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16
SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Interior gypsum board.
B. Related Sections include the following:
   1. Division 9 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.
   2. Division 9 painting Sections for primers applied to gypsum board surfaces.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated.

1.3 STORAGE AND HANDLING
A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.4 PROJECT CONDITIONS
A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
B. Do not install interior products until installation areas are enclosed and conditioned.
C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL
A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Gypsum Co.
      b. G-P Gypsum.
      c. National Gypsum Company.
      d. PABCO Gypsum.
      e. USG Corporation.

B. Regular Type:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

C. Type X:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      e. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
   3. Fill Coat: For second coat, use drying-type, all-purpose compound.
   4. Finish Coat: For third coat, use drying-type, all-purpose compound.
2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
   1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Regular Type: Vertical surfaces, unless otherwise indicated.
2. Type X: Where required for fire-resistance-rated assembly.
3. High-Impact Type: Where indicated.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer’s written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. U-Bead: Use at exposed panel edges.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
   a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00
SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes porcelain and ceramic tile products on walls and floors in toilet and locker rooms. Substrates include cementitious backer board and concrete masonry at walls and at floors, concrete slabs-on-grade and suspended concrete slabs. Materials include the following:

1. Porcelain/Quarry tile.
2. Glazed wall tile.
3. Elastomeric Joint Sealant in tile fields.
4. Tile cleaner and sealer.
5. Mortar & Grout.

B. Related Sections include the following:

1. Division 3 Section "Cast-In-Place Concrete" for slab finishes specified for tile over concrete substrates.

1.2 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:

1. Level Surfaces: Minimum 0.6.

1.3 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, and other products specified.

1.4 QUALITY ASSURANCE

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

B. Source Limitations for Tile: Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:
1. **Cementitious backer units.**
2. **Joint sealants.**
3. **Waterproofing.**

### 1.5 DELIVERY, STORAGE, AND HANDLING

**A.** Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

**B.** Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

### 1.6 PROJECT CONDITIONS

**A.** Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

### 1.7 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 labels describing contents.

1. **Tile and Trim Units:** Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.
2. Obtain a written receipt from the Owner’s Representative, to include in Closeout Documents.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

**A.** Products: Basis of Specification is Dal Tile Company and Crossville Ceramics products indicated in the ceramic tile installation schedules and in the Finishes Legends located on individual drawing sheets.

**B.** Manufacturers: Subject to compliance with requirements, and properties of the specified products, including color selection, products by the following will be considered if submitted before Bids are received in accordance with the Instructions to Bidders:

1. **Tile Products:**
   a. American Marrazzi Tile, Inc.
   b. American Olean Tile Co.
   c. Dal-Tile Corporation.
   d. Facings of America
   e. Florida Tile Industries, Inc.
   f. Kaiser Tile
   g. Mannington Ceramic Tile.
   h. Monarch Tile, Inc.
   i. Quarry Tile Company.
   j. United States Ceramic Tile Company.

2. **Tile-Setting and -Grouting Materials:**
   b. Custom Building Products.
   c. Dal-Tile Corporation.
2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.


C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Match colors, textures, and patterns indicated by referencing manufacturer's standard designations for these characteristics.
2. Provide tile trim and accessories as indicated in the Schedule.

D. Factory Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

2.3 TILE PRODUCTS

A. Porcelain/Quarry Floor Tile: Provide flat tile complying with the following requirements:

1. See Finishes Legend and Schedule on individual drawing sheets for description and location.

B. Glazed Wall Tile: Provide flat tile complying with the following requirements:

1. See Finishes Legend and Schedule on individual drawing sheets for description and location.

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:

1. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
2. Shapes: As indicated on the Drawings or if not indicated, as follows, selected from manufacturer's standard shapes:
   a. Provide coved base at unglazed floor tile.
   b. Wainscot Cap for Thin-Set Mortar Installations: Surface bullnose.
   c. External Corners for Thin-Set Mortar Installations: Surface bullnose/metal corner trim as indicated in Finish Legends and on drawing sheets.
   d. Internal Corners: Field-butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.
   e. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide a reduction in
thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

2.4 SETTING MATERIALS

A. Portland Cement Mortar Installation Materials: Provide materials complying with ANSI A108.1A and as specified below:

1. Latex additive (water emulsion) described below, serving as replacement for part or all of gaging water, of type specifically recommended by latex additive manufacturer for use with job-mixed Portland Cement and aggregate mortar bed.
   a. Latex Additive: Manufacturer's standard.

B. Latex-Portland Cement Mortar: ANSI A118.4, composed as follows:

1. Prepackaged Dry-Mortar Mix: Factory-prepared mixture of Portland Cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to which only water needs to be added at Project site.
   a. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.5 GROUTING MATERIALS

A. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:

1. Factory-Prepared, Dry-Grout Mixture: Factory-prepared mixture of Portland cement; dry, redispersible, ethylene vinyl acetate additive; and other ingredients to produce the following:
   a. Unsanded grout mixture for joints 1/8 inch (3.2 mm) and narrower.

B. Floor Grout: Two-component, chemical resistant, non-sagging epoxy grout which is water cleanable; grout shall comply with ANSI A118.3. Colors as indicated in Finishes Legend on individual drawing sheets. The following manufacturers and products are approved:

1. Laticrete International “Latapoxy SP-100 Stainless Epoxy Grout (Series 700)”.
2. Mapei, Inc. “Kerapoxy 400 100% Solids Epoxy Grout”.
3. Bostik Construction Products “Hydroment Colo-Poxy”.
4. Custom Building Products “100% Solids Epoxy Grout”.

2.6 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section “Joint Sealants.”

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to non-porous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other non-porous substrates that are subject to in-service exposures of high humidity and temperature extremes.

1. Provide at joints of ceramic wall tile and ceiling surface, around pipe penetrations, plumbing fixtures and trim.
2. Provide at perimeter of toilet room accessories such as grab bars, towel bars, paper and soap dispensers provided on or within walls in accordance with UBC, 1997 Edition, Section 807.1.2

C. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

1. Provide at control joints in floors where indicated, or if not indicated, over control joints in substrates and at 30-feet maximum spacing.

D. Products: Subject to compliance with requirements, provide one of the following:

1. One-Part, Mildew-Resistant Silicone Sealants:
   a. Dow Corning 786; Dow Corning Corporation.
   b. Sanitary 1700; GE Silicones.
   c. Pecora 898 Sanitary Silicone Sealant; Pecora Corp.
   d. Rhodorsil 6B White; Rhone-Poulenc, Inc.
   e. Tremsil 600 White; Tremco, Inc.

2. Multipart, Pourable Urethane Sealants:
   a. Chem-Calk 550; Bostik.
   b. Vulkem 245; Mameco International, Inc.
   c. NR-200 Urexpan; Pecora Corp.
   d. THC-900; Tremco, Inc.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Cementitious Backer Units: ANSI A118.9 or ASTM C1325 ½ inch (12.7 mm) thick.

C. Metal Edge Strips: White-zinc-alloy terrazzo strips, 1/8 inch (3.2 mm) wide at top edge with integral provision for anchorage to mortar bed or substrate, unless otherwise indicated.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

E. Tile Sealer: Aqua Mix “Sealer’s Choice 15 Gold.”

1. Description: No-sheen, water-based penetrations sealer.
2. Application: Two coats in accordance with manufacturer’s recommendations.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers’ written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

1. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions.

2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.


C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned
joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. Lay out tile wainscots (if indicated) to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

H. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial Portland Cement, and latex-Portland Cement grouts), comply with ANSI A108.10.

3.4 FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards.

B. Joint Widths: Install tile on floors with the following joint widths:

1. Porcelain/Quarry Tile: 1/4 inch.

C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.5 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:

2. Porcelain “SlimLite” Panels: 1/16”.

C. Exterior Corner Trim: Install at locations where tile wraps exterior corners to finished height of tile. Product as indicated in Finish Legend on individual drawing sheets.
3.6 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove latex-portland cement grout residue from tile as soon as possible.
   2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer’s written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure tile is without damage or deterioration at the time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

3.7 CERAMIC TILE INSTALLATION SCHEDULE

A. Ceramic/Quarry Tile Floor Installation. Comply with the following:
   1. Tile Type: Porcelain tile over concrete slabs. Provide products according to the Finishes Legend on individual drawing sheet.
   2. Provide according to TCA Installation Method F113, Thinset.
      a. Latex Portland Cement mortar, ANSI A118.4.
      b. Latex Portland Cement grout, ANSI A118.6.

B. Ceramic Wall Tile over Cementitious Backer Units: Comply with the following:
   1. Tile Type: Ceramic wall tile. Provide products according to the Finishes Legend on individual drawing sheets.
   2. Provide according to TCA Installation Method W244.
      a. Latex Portland cement mortar, ANSI A118.4.
      b. Latex Portland cement grout, ANSI A118.6.

END OF SECTION 09 30 00
SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.2 DEFINITIONS
A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Maintenance Data: For finishes to include in maintenance manuals.

1.4 QUALITY ASSURANCE
A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
   2. Suspension System: Obtain each type through one source from a single manufacturer.
B. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
   2. UBC Standard 25-2, "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings."

1.5 DELIVERY, STORAGE, AND HANDLING
A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

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

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.7 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface per ASTM E 795.

2.3 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Products: USG Interiors 562 Fissured.

B. Classification: Class A.

C. Color: White.

D. LR: .81.

E. NRC: .55.

F. CAC: 35
G. Edge Detail: Square.

H. Thickness: 5/8”.

I. Size: 2’ x 4’.

J. Location: See Finishes Legend and Finish Schedule on individual drawing sheets for location.

2.4 WATER-FELTED, MINERAL-BASE ACOUSTICAL PANELS, VINYL LAMINATED FACE WITH SEALED BACK AND EDGES FOR ACOUSTICAL PANEL CEILING

A. Products: USG Interiors Clean Room Climaplus

B. Color: White.

C. LR: .79.

D. NRC: 0.

E. CAC: 35.

F. Edge Detail: Square.

G. Thickness: 5/8”.

H. Size: 2’ x 4’.

I. Location: See Finishes Legend and Finish Schedule on individual drawing sheets for location.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in-place.
G. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Manufacturers:

1. Armstrong World Industries, Inc.
2. Celotex Corporation
3. Chicago Metallic Corp.
4. USG Interiors, Inc.

B. Steel Suspension Systems:

1. USG DONN-DX Grid 15/16”.

C. Aluminum Suspension Systems:

1. USG DONN-DXLA 15/16”.

2.7 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers:

1. Armstrong World Industries, Inc.
2. Celotex Corporation; Architectural Ceilings Marketing Dept.
3. Chicago Metallic Corporation.
4. USG Interiors, Inc.

B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

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

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

A. General: Install acoustical panel ceilings to comply with UBC Standard 25-2 and seismic requirements indicated, per manufacturer’s written instructions and CISCA’s "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building’s structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.66 m). Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
   a. Pop rivets acceptable at 9/16” grid only. Painted to match grid.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
3.4 CLEANING

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

END OF SECTION 09 51 13
SECTION 09 65 13
RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Resilient wall base.
   2. Reducer strips.

B. Related Sections include the following:
   1. Division 9 Section "Resilient Tile Flooring."

1.2 SUBMITTALS

A. Product Data: For each type of product specified.

B. Product Certificates: Signed by manufacturers of resilient wall base and accessories certifying that each product furnished complies with requirements.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.

   1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
   2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F (10 and 32 deg C).

C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.5 PROJECT CONDITIONS

A. Maintain a temperature of not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After
postinstallation period, maintain a temperature of not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

B. Do not install products until they are at the same temperature as the space where they are to be installed.

C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.

D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Wall Base and Accessories: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design product is Johnsonite wall base. Color as indicated in the Finish Legend. Subject to compliance with Division 1 Requirements, and this specification section, products from other manufacturer’s may be considered.

2.2 RESILIENT ACCESSORIES

A. Rubber Accessories: Products complying with requirements specified below.

B. Color and Pattern: As selected by Architect from manufacturer’s full range of colors and patterns produced for resilient accessories complying with requirements indicated.

C. Product Types: Provide resilient accessories for the project including but not limited to the following types:

1. Reducer strip for resilient flooring. Carpet to concrete. Vinyl tile or VCT to concrete, carpet to VCT or vinyl tile.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Install resilient products according to manufacturer's written installation instructions.

B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
3. Do not stretch base during installation.
4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.
3.4 EXCESS MATERIALS AND WASTE

A. Recycling: Separate and recycle all waste materials in accordance with the Contractor's waste management plan and to the extent economically feasible. This includes metal banding, pallets, and other shipping materials in addition to waste resulting from installation operations.

3.5 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing resilient products:

1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
2. Sweep or vacuum horizontal surfaces thoroughly.
3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
4. Damp-mop or sponge resilient products to remove marks and soil.

B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

1. Cover resilient products installed on floors with undyed, untreated building paper until inspection for Substantial Completion.

END OF SECTION 096513
SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Vinyl composition tile (VCT).
2. Luxury vinyl tile.
3. Recycled rubber tile.
4. Rubber tile.

B. Related Sections include the following:

1. Division 9 Section 09 65 13 "Resilient Wall Base and Accessories".

1.2 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.

1. All types and styles of tile products.

D. Maintenance Data: For resilient products to include in maintenance manuals.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 PERFORMANCE REQUIREMENTS

A. Floor Score Compliance: Resilient floor tile shall comply with requirements of Floor Score standard.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store tiles on flat surfaces.

1.6 PROJECT CONDITIONS

A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.
B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Basis of this Specification is as follows, with pattern and color as indicated in the Finishes Legend on individual drawing sheets.

B. Subject to compliance with the requirements and properties of the product listed, including acceptable color and texture, products of other manufacturers will be considered if submitted prior to Bid in accordance with the stipulations in the Instructions to Bidders.

2.2 VINYL COMPOSITION TILE (VCT)

A. Manufacturer/Product: Armstrong – Excelon.


C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Fire-Test-Response Characteristics:

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.3 LUXURY VINYL TILE (VT)

A. Manufacturer/Product: Amtico International.

B. Tile Standard: ASTM F 1700, Class II.

C. Wearing Surface: Smooth.

D. Thickness: 2.5 mm.

E. Size: See Finish Legend on individual drawing sheets.
F. Fire-Test-Response Characteristics:
   1. ASTM E648, Class I.
   2. ASTM E662 (Non-Flaming) DM Corrected: <450.

2.4 RECYCLED RUBBER TILE (RRT)
   A. Manufacturer/Product: To Market – Atmosphere/Earthshapes.
   B. Tile Standard:
   C. Wearing Surface: Smooth.
   D. Thickness: 4 mm.
   E. Size: 38” x 38”.
   F. Fire-Test-Response Characteristics:

2.5 RUBBER TILE (RT)
   A. Manufacturer/Product: Johnsonite – Matera.
   B. Tile Standard: ASTM F 1344, Class I-A and I-B.
   C. Wearing Surface: Hammered Surface.
   D. Thickness: 1/8” (3.17mm).
   E. Size: 24” x 24”.
   F. Fire-Test-Response Characteristics:
      2. Smoke Density: ASTM E 662/NFPA 258, less than 450.

2.6 INSTALLATION MATERIALS
   A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by resilient product manufacturer for applications indicated.
   B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
   A. Transition Edge Strips: As indicated in Finish Legend on individual drawing sheets to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
3. Moisture Testing:
   a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
   b. Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

D. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

E. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

1. Do not install resilient products until they are same temperature as space where they are to be installed.

F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis in pattern indicated.
B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.

D. Extend tiles into toe spaces, door reveals, closets, and similar openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing resilient product installation:

   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

   a. Do not wash surfaces until after time period recommended by manufacturer.

B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.

   1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.

   a. Use commercially available product acceptable to manufacturer and as approved by the Owner’s maintenance service.

   2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
   3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Waxing.

   1. Apply three (3) coats of manufacturer recommended wax to installed VCT. Verify type used with maintenance manager.
   2. Apply coatings prior to installing display, cashier, railing units.
   3. Apply coatings per manufacturer’s recommendations.
END OF SECTION 096519
SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes modular, tufted carpet tile.

B. Related Sections include the following:
   1. Division 9 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 SUBMITTALS

A. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Existing flooring materials to be removed.
   3. Existing flooring materials to remain.
   4. Transition details to other flooring materials.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

C. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."
B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis of this Specification, including color, is indicated in the Finishes Legend on individual drawing sheets. Subject to compliance with the requirements and properties of the product listed, including acceptable color and characteristics, products of other manufacturers will be considered if submitted prior to Bid in accordance with the stipulations in the Instructions to Bidders.

1. Carpet tile shall meet the testing and product requirements of the Carpet and Rug Institute Green Label Plus program.

2.2 INSTALLATION ACCESSORIES

A. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. VOC Limits: Provide adhesives with VOC content not exceeding 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

1. Remove any remaining pieces of previous floor finish.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

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

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions: Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
B. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

C. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern as shown on drawings, parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

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

END OF SECTION 09 68 13
SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation, painting and finishing of exposed interior items and surfaces as defined in the Master Painters Institute (MPI) Architectural Painting Manual and the following:

1. Surface preparation, priming and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
2. Special Preparation and repainting of existing surfaces.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 7 Section "Joint Sealants" for caulking of interior joints at or adjacent to surfaces to be painted.
2. Division 5 Section, "Metal Fabrications" for shop-priming ferrous metal.
3. Division 8 Section, "Steel Door and Frames" for shop-priming steel doors and frames.

C. Paint exposed surfaces whether or not colors are designed in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

1. Painting includes field-painting exposed bare and covered pipes and ducts, hangers, exposed steel and iron work and primed metal surfaces of mechanical and electrical equipment.
2. In general, conduit, ducts, piping and like material exposed in a room or area scheduled to be painted shall be painted, same color as the adjacent surface unless otherwise indicated.
3. Painting includes field natural finishing of wood doors.

D. Painting is not required on prefinished items (except as noted), finished metal surfaces, concealed surfaces, operating parts and labels.

1. Prefinished items not to be painted include the following factory-finished components:
   a. Acoustic materials.
   b. Plastic laminated architectural casework.
   c. Finished mechanical and electrical equipment.
   d. Light fixtures.
   e. Switchgear.
   f. Distribution cabinets.
   g. Prefinished toilet compartments.

2. Concealed surfaces not to be painted include wall or ceiling surfaces in inaccessible areas.

3. Finished metal surfaces not to be painted include:
   a. Anodized aluminum
   b. Stainless steel and Chromium plate.
   c. Copper, bronze and brass
4. Operating parts not to be painted include moving parts of operating equipment such as the following:
   a. Valve and damper operators
   b. Linkages
   c. Sensing devices
   d. Motor and fan shafts

5. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating or nomenclature plates.

1.2 SUBMITTALS

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

B. Product data for each paint system specified, including block fillers and primers.
   1. Provide the manufacturer's technical information including label analysis and instructions for handling, storage and application of each material proposed for use.
   2. List each material and cross-reference the specific coating, finish system and application. Identify each material by the manufacturer's catalog number and general classification.
   3. Submit Material Safety Data Sheets to Owner's Representative at least two weeks before material is delivered to the site.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to those indicated for the Project that have resulted in a construction record of successful in-service performance.

B. Single-Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

C. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

D. Paint Grade: ‘Premium’ as defined by the MPI.

E. Employ only qualified journeymen in this painting and decorating work; apprentices may be employed on the project to work under the direction of qualified journeymen.


G. All paint manufacturers and products used shall be as listed under the “Approved Products” section of the MPI Architectural Painting Specification Manual.
1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened packaged and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type)
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing and application.

1.5 JOB CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperature are between 45 deg F (7 deg C) and 95 deg F (35 deg C).

C. Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

D. Do not proceed with any work under this Section unless a lighting level of a minimum of 15 candlepower per square foot is provided on the surfaces to be finished.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) shall be in accordance with the MPI Architectural Painting Specification Manual “Approved Product” listing and shall be from a single manufacturer for each system used.

B. Other paint materials such as linseed oil, shellac, etc. shall be the highest quality product of an approved manufacturer listed in the MPI Architectural Painting Specification Manual and shall be compatible with other coating materials as required.
C. All materials and paints shall be lead and mercury free and shall have low VOC content where possible.

D. Manufacturer: Provide products according to the manufacturer and product identification listed in the paint schedules below. Subject to conformance with requirements and properties of the products listed, products of the following manufacturers will be considered.

1. Benjamin Moore & Co. (Moore)
2. Columbia Paint Co. (Columbia)
3. Fuller (Fuller)
4. Parker Paint Mfg. Company (Parker)
5. PPG Industries, Pittsburgh Paints (PPG)
6. Rodda Paint Co. (Rodda)
7. The Sherwin-Williams Company (S-W)

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, finish coat materials and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Material Quality: Provide the manufacturer's product as specified. Paint material containers not displaying manufacturer's product identification shall not be brought to the job site.

C. Paints shall comply with Green Seal Standard GS-11 points.

D. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

1. Flat Paints and Coatings: VOC not more than 50 g/L.
2. Non-Flat Paints and Coatings: VOC not more than 150 g/L.
3. Anti-Corrosive Coatings: VOC not more than 250 g/L.
4. Varnishes and Sanding Sealers: VOC not more than 350 g/L.
5. Stains: VOC not more than 250 g/L.
6. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
7. Restricted Components: Paints and coatings shall not contain any of the following:

   a. Acrolein.
   b. Acrylonitrile.
   c. Antimony.
   d. Benzene.
   e. Butyl benzyl phthalate.
   f. Cadmium.
   g. Di (2-ethylhexyl) phthalate.
   h. Di-n-butyl phthalate.
   i. Di-n-octyl phthalate.
   j. 1, 2-dichlorobenzene.
   k. Diethyl phthalate.
   l. Dimethyl phthalate.
   m. Ethylbenzene.
   n. Formaldehyde.
2.3 COLOR SCHEDULE

A. Where colors are identified by product names and numbers, provide perfect color match to the listed colors. See "P" numbers in the Finishes Legend and Finish Schedule.

2.4 GLOSS

A. MPI Gloss and Sheet Standards are now as follows:

<table>
<thead>
<tr>
<th>Gloss Level</th>
<th>Description</th>
<th>Gloss @ 60°</th>
<th>Sheen @ 85°</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Gloss Level 1: A traditional matte finish – flat</td>
<td>Max. 5 units</td>
<td>Max. 10 units</td>
</tr>
<tr>
<td>2.</td>
<td>Gloss Level 2: A high side sheen flat – ‘a velvet-like’ finish</td>
<td>Max. 10 units</td>
<td>10 – 35 units</td>
</tr>
<tr>
<td>4.</td>
<td>Gloss Level 4: A ‘satin-like’ finish</td>
<td>20 – 35 units</td>
<td>Min. 35 units</td>
</tr>
<tr>
<td>5.</td>
<td>Gloss Level 5: A traditional semi-gloss</td>
<td>35 – 70 units</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Gloss Level 6: A traditional gloss</td>
<td>70 – 85 units</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Gloss Level 7: A high gloss</td>
<td>More than 85 units</td>
<td></td>
</tr>
</tbody>
</table>

2.5 PAINT SCHEDULE

A. Interior Surfaces: Paint interior surfaces in accordance with the following MPI Architectural Painting Specification Manual requirements:

1. Concrete Horizontal Surfaces: Exposed floors.
   a. INT.3.2G: Concrete Floor Sealer (water-based).

2. Metal Fabrications: For steel exposed to view.
   a. INT 5.1B: High performance acrylic (Gloss Level 5) finish.

3. Galvanized Metal: Doors, frames, miscellaneous steel, pipes, ducts, etc.
   a. INT 5.3B: High performance acrylic (Gloss Level 5) finish.

4. Dressed Lumber: Including trim, casings, etc.
   a. INT 6.3A: Latex (Gloss Level 3) finish.

5. Gypsum Board: Gypsum wallboard, drywall, “sheet rock type material,” etc.
   a. INT 9.2B: High performance acrylic (Gloss Level 3, except in Toilet Rooms, Custodial Rooms, IDF Rooms, Tech. Closets and Electrical Room where Level 5 is required. Gloss Level 2 at ceilings except for Gloss Level 5 where Gloss Level 5 is required on walls) finish.

6. Concrete Masonry Units:
   a. INT 4.2.D: High Performance Architectural Latex; (gloss level 3) finish.
PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with paint application requirements. Surfaces receiving paint must be thoroughly dry before paint is applied.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures and similar items already installed that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items, if necessary, to completely paint the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatment, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease prior to cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to the manufacturer’s instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing about anticipated problems using the specified finish-coat material with substrates primed by others.

2. Wood: Clean surfaces of dirt, oil and other foreign substances with scrapers, mineral spirits and sandpaper as required. Sand surfaces exposed to view smooth and dust off.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides and backsides of wood including cabinets, trim, counters, cases and paneling.
   c. When transparent finish is required, backprime with spar varnish.
   d. Backprime paneling on interior partitions where masonry, plaster or other wet wall construction occurs on backside.
   e. Seal tops, bottoms and cutouts of primed or unprimed wood doors with a heavy coat of varnish, primer or sealer immediately upon delivery.

3. Ferrous Metals: Clean ungalvanized ferrous metal surfaces that have not been shop-coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council (SSPC).
a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

5. Cementitious Materials: Prepare concrete, cement plaster and reinforced concrete panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by the coating manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish coating to blister and burn, correct this condition before coating application. Do not paint surfaces where moisture content exceeds that permitted in the manufacturer's printed directions.

### 3.3 ADDITIONAL REQUIREMENTS FOR EXISTING SURFACES SCHEDULED FOR REPAINT

A. General: Reference is made to the MPI Architectural Painting Specification Manual for the terminology used to describe the existing conditions. This information is not intended to permit or encourage the Bidder/Contractor to forgo site visits and inspections to determine actual conditions before the Contract is awarded.

### 3.4 MATERIALS PREPARATION

A. General: Carefully mix and prepare paint materials according to manufacturer's directions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials or residue.
2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
3. Use only thinners approved by the paint manufacturer and only within recommended limits.

B. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.5 APPLICATION

A. General: Apply paint according to manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions detrimental to formation of a durable paint film.

1. Paint surface treatments and finishes are indicated in the schedules.
2. Provide finish coats that are compatible with primers used.
3. The number of coats and the film thickness required are the same regardless of the application method. Do not apply succeeding coats until the previous coats has cured as recommended by the
manufacturer. Sand between applications where sanding is required to produce a smooth even surface according to the manufacturer's directions.

4. Apply additional coats if undercoats, stains or other conditions show through final coat of paint until paint film is of uniform finish, color and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

5. The term exposed surfaces includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles and similar components are in place. Extend coating in these areas, as required, to maintain the system integrity and provide desired protection.

6. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.

8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

9. Omit primer on metal surfaces that have been shop-primed and touch-up painted.

10. Paint unfinished wood cleats, underside of casework, desk tops and similar items.

C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

D. Application Procedures: Apply paints and coatings by brush, roller, spray or other applicators according to the manufacturer's directions and requirements of the surface to be painted.

1. Brushes: Use brushes best suited for the material applied.

2. Rollers: Use rollers of carpet, velvet back or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

3. Spray Equipment: Use airless spray equipment with orifice size and recommended by the manufacturer for the material and texture required.

E. Minimum Coating Thickness: Apply materials no thinner than the manufacturer's recommended spreading rate. Provide the total dry film thickness of not less than 4.0 mils for the entire system of prime and finish coats for three coat work, or 2.5 mils where two coat work is specified.

F. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime-coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

G. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks or other surface imperfections.

H. Pigmented (Opaque) Finishes: Completely cover to provide a smooth, opaque surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

I. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes or other surface imperfections.

1. Provide satin finish for final coats.
J. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not complying with specified requirements.

3.6 CLEANING

A. Cleanup: At the end of each work day, remove empty cans, rags, rubbish and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.7 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing and repainting as acceptable to the Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 099000
SECTION 10 14 00

SIGNS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. ADA Room Identification Signage (Panel signs).

B. Related Sections: The following sections contain requirements that relate to this section:

1. Division 1 Section "Temporary Facilities" for temporary project identification signs.
2. Division 15 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
3. Division 16 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.
4. Division 16 Section "Emergency Lighting" for illuminated exit signs.
5. Electrical service and connections for illuminated letters are specified in Division 16.

1.2 SUBMITTALS

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

B. Product data from each manufacturer for each type of product specified, including construction details relative to materials, dimensions of individual components, profiles, finishes and accessories for each type of sign and dimensional letter and number required.

C. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include elevations and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details. Provide text for each sign required, including large scale details of wording and layout of lettering.

D. Panel sign samples: Provide one full size sample of each type of sign specified for initial selection of color, pattern and surface texture required. On each panel include a representative example of the graphic image process required, showing graphic style, colors and finishes of letters, numbers and other graphic devices as required and for verification of compliance with requirements indicated.

E. Dimensional letters and number samples: Provide full-size representative sample of each dimensional letter type required, showing letter style, color, and material finish and method of attachment, as required and for verification of compliance with requirements indicated.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: For each separate type of sign required, obtain signs from one source from a single manufacturer.

B. Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Signs: Specifications are based on Interface Architectural Signage. Subject to compliance with requirements and properties of the products specified, products by the following manufacturers will be considered:

1. ANDCO Industries Corp.
2. Best Manufacturing Company.
3. Charleston Industries, Inc.
4. DGS Corp.
5. Diskey Sign Corp.
8. Modulex.
10. Poblocki & Sons, Inc.
11. Spanjer Brothers, Inc.
12. The Supersine Company.
13. Vomar Products, Inc.

2.2 UNFRAMED PANEL SIGNS

A. General: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth, even level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
2. Text shall be centered at top of signs, with symbol centered.
3. Braille shall be produced by extracting the background of the plaque using a photo etching process, leaving the copy and braille raised. The plaque shall then be laminated to an opaque acrylic base, cut to size and finished with a professional surface painted acrylic polyurethane enamel in a specified color. The photo etched plaque shall have raised Grade 2 Braille, meeting both ADA and ANSI guidelines.

2.3 FABRICATION

A. Signs: Plaque face; 1/32" raised copy, integral copy/Braille, 1/8" thick opaque acrylic base. Comply with ADA.

1. Raised Copy: Produced by photo mechanical etching process.
2. Plaque background color to be Interface #5 Slate.
3. Plaque face shall be laminated to 1/8" thick opaque acrylic base.
4. Text, logos, and border design, precision cut, 1/32" minimum thickness, black or white, polyurethane enamel finish, upper case. Helvetica medium style, shall be chemically welded to the face of the plaque.
5. Edge Condition: Beveled.

2.4 SIGN TYPES

A. ADA, text, Braille text and symbol as indicated, 8-3/4" x 8-3/4", plaque.
1. Men/Women with universal symbols and universal accessibility symbol.
2. “Keep This Door Unlocked During Business Hours”.
3. Maximum Occupancy: ______

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate signs and dimensional letter units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.  
   1. Install signs and dimensional letters level, plumb, and at the height indicated and free from distortion or other defects in appearance, with sign surfaces free from distortion or other defects in appearance.

B. Wall Mounted Panel Signs: Attach panel signs to wall surfaces using double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces. Use silastic adhesive for irregular or porous surfaces or where sign occurs on a vinyl covered surface.

   Provide signs on wall adjacent to latch side of door, with Braille between 48” and 60” above finish floor unless otherwise noted.

   1. Mount sign so that a person may approach within 3” of sign without encountering protruding objects or standing within the swing of a door.
   2. Signs at exterior entrances shall be installed adjacent to the entrance as directed by AAFES.

C. Dimensional letters: Installed with manufacturer's recommended spacing, align all letters with each other, level and plumb.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by AAFES.
SECTION 10 21 13
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes toilet compartments and screens

B. Related Sections include the following:
   1. Division 10 "Toilet and Bath Accessories" for toilet paper holders, grab bars, purse shelves, and similar accessories.

1.2 SUBMITTALS

A. Product Data: For each type and style of toilet compartment and screen specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of reinforcement and cutouts for compartment-mounted toilet accessories.

1.3 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Solid plastic toilet compartments and urinal screens: Subject to compliance with requirements. Basis of this specification is Scranton Products “Hiny Hiders” solid plastic partitions.

1. Accurate Partitions Corporation.
2. All American Metal Corp.
3. Ampco Products, Inc.
5. Capitol Partitions, Inc.
6. Crane Plumbing; Sanymetal.
8. Global Steel Products Corp.
9. Metpar Corp.
11. Scranton Products.
2.2 MATERIALS

A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.

B. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch (0.8 mm) thick and 3 inches (75 mm) high, finished to match hardware.

C. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of the following material:
   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

D. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:

E. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.

F. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.

G. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.

   1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.

B. Toilet Compartments: Floor supported, headrail braced type solid plastic compartments of types and manufacturers as follows, or approved equal. Basis of Design is Scranton Products.

   1. Acurate Partitions Corporation “Floor Anchored/Overhead braced”.
   2. Global “Floor Anchored/Overhead braced”.
   3. Knickerbocker “Floor Anchored/Overhead braced”.
   4. Sanymet “Floor Anchored/Overhead braced”.
   5. General Partitions Corporation “Floor Anchored/Overhead braced”.
   6. Flush-Metal Partitions “Floor Anchored/Overhead braced”.
   7. Scranton Products “Floor Anchored/Overhead Braced”.

C. Urinal Screens: Wall hung solid plastic, 18 inches by 42 inches, of types and manufacturers as follows, or approved equal. Basis of Design is Scranton Products.

   1. Acurate Partitions Corporation “Wall Hung”.
   2. Global “Wall Hung”.
3. Knickerbocker “type WH”.
4. Sanymetal “Type C”.
5. General Partitions Corporation “WHF-3”.
6. Flush-Metal Partitions “Type WH”.
7. Scranton Products.

D. Concealed Anchorage Reinforcement: Minimum 12 gage galvanized steel sheet.

E. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer’s standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

F. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels, unless otherwise indicated.
   1. Provide solid plastic screens with integral full-height flanges for attachment to wall.

G. Doors: Unless otherwise indicated, provide 24-inch- (610-mm-) wide in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide out-swinging doors with a minimum 32-inch- (813-mm-) wide clear opening for compartments indicated to be handicapped accessible.
   1. Hinges: Manufacturer’s standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
   2. Latch and Keeper: Manufacturer’s standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide units that comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be handicapped accessible.
   3. Coat Hook: Manufacturer’s standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.
   4. Door Bumper: Manufacturer’s standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
   5. Door Pull: Manufacturer’s standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.

2.4 SPECIAL FEATURES

A. Reinforcing: Provide special reinforcing in core construction of panels scheduled to receive grab bars. Design reinforcement to support grab bars under a minimum 300 pound shear load at each connection point.

B. Provide stainless steel loop door pulls on each side of door to handicap stall and next adjacent stall if applicable. Doors to stalls with pulls to open outward.

2.5 TYPE AND COLOR:

A. See Finishes Legend.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch (13 mm) between pilasters and panels and not more than 1 inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

1. Secure panels to walls and panels with not less than 2 stirrup brackets attached near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 EXCESS MATERIALS AND WASTE

A. Recycling: Separate and recycle all waste materials in accordance with the Contractor's waste management plan and to the extent economically feasible. This includes metal banding, pallets, and other shipping materials in addition to waste resulting from installation operations.

3.3 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions 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 swing doors in entrance screens to return to fully closed position.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 102113
SECTION 10 26 00
WALL AND DOOR PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of wall surface protection systems:
   1. Wall protection systems.
      a. Corner guards.
      b. Cart bumper rails.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Wood blocking and grounds for corner guards are included in Division 6 Section "Rough Carpentry."
   2. Stainless steel mop plates, kick plates, and armor plates are included in Division 8 Section "Door Hardware."

1.2 SUBMITTALS

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

B. Product data for each wall surface protection system component and installation accessory required, including installation methods for each type of substrate. Provide written data on each required component including physical characteristics, such as durability, resistance to fading, and flame resistance.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has previously installed wall surface protection systems similar in material, design, and extent to the systems indicated for this Project.

B. Impact Strength: Provide wall surface protection system components with a minimum impact resistance of 16 ft. lbs per sq. ft. when tested in accordance with ASTM D 256 (Izod impact, ft. lbs per inch notch).

C. Single Source Responsibility: Obtain each color, grade, finish, and type of wall surface protection system component from a single source with resources to provided products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original factory wrappings and containers, clearly labeled with identification of manufacturer, brand name, quality or grade, and fire hazard classification.

1.5 MAINTENANCE

A. Maintenance Instructions: Provide the manufacturer's instructions for maintenance of installed work. Include recommended methods and frequency for maintaining optimum condition under anticipated traffic and use conditions. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.
B. Replacement Materials: After completion of work, deliver not less than 2 percent of each type, color, and pattern of wall surface protection materials and components. Include accessory components as required. Replacement materials shall be from the same production run as materials installed. Package replacement materials with protective covering, identified with appropriate labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. American Floor Products Co., Inc.
2. Balco, Inc.
4. Construction Specialties, Inc.
5. K. J. Miller Corporation.
7. Pawling Corporation.
8. Tepromark International, Inc.
10. Tubular Specialties.
12. McCue Corporation.

2.2 MATERIALS

A. Polycarbonate Plastic Sheet: Abrasion-resistant, clear, transparent polycarbonate plastic sheet with an impact resistant rating of 16 ft. lb. per inch tested in accordance with ASTM D 256.

B. Fasteners for Corner Guards: Provide aluminum, nonmagnetic stainless steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with aluminum components, hardware, anchors, and other items being fastened. Use theft-proof fasteners where exposed to view.

2.3 CORNER GUARDS

A. Stainless-Steel Corner Guards: Paper-covered, satin-finish, 0.0625-inch (1.6-mm) minimum, stainless-steel sheet corner guards; height as indicated. Provide 90-degree turn, unless otherwise indicated; and formed edges. Stainless steel plate Type 304 minimum 0.625 inches thick.

1. Provide corner guards in shapes, as noted below and as detailed on the drawings.

   a. Wing Size: 1-1/2 by 1-1/2 inches.
   c. Corner Radius: 1/8 inch (3.2 mm).
   d. Height: Provide corner guards on all outside corners to heights at the area locations specified below:
      1) MPA – to 8'-0" above finished floor.
      2) Food Court, Mall and other locations – to 10'-0" above finished floor.

B. Polycarbonate Corner Guards: Provide clear scratch resistant polycarbonate corner guards, height as indicated. Provide 90° turn, unless otherwise indicated.

1. Size: 1-1/2" x 1-1/2".
3. Corner Radius: 1/8”.
4. Height: 10'-0”.
5. Location: Retail all outside corners.

2.4 CART BUMPER RAIL

A. McCue Corporation – CartStop BR.
   1. Floor mounted.

2.5 FABRICATION

A. General: Fabricate wall and door protection systems to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thicknesses of components.

B. Preassemble components in the shop to the greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of evidence of wrinkling, chipping, uneven coloration, dents, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

D. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors for interconnection of members to other construction.

E. Provide inserts and other anchorage devices for connecting components to concrete or masonry. Fabricate anchoring devices to be capable of withstanding imposed loads. Coordinate anchoring devices with the supporting structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which wall surface protection components and wall protection systems will be installed.
   1. Complete all finishing operations, including painting, before beginning installation of wall surface protection system materials.

B. Do not proceed with installations until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prior to installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install wall surface protection units plumb, level, and true to line without distortions.
   1. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished work.
3.4 CLEANING

A. General: Immediately upon completion of installation, clean plastic covers and accessories using a standard ammonia based household cleaning agent. Clean metal components in accordance with the manufacturer's recommendations.

B. Remove excess adhesive using methods and materials recommended by manufacturer.

C. Remove surplus materials, rubbish, and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

END OF SECTION 10 26 00
SECTION 10 28 00
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes toilet and dressing room accessory items as follows:
   1. Automatic paper towel dispenser.
   2. Grab bars.
   3. Sanitary disposal unit.
   4. Soap dispenser.
   5. Mirrors.
   6. Diaper changing station.
   7. Child protection seat.
   8. Toilet tissue dispensers.
   9. Folding and fixed shelves.
  10. Seat cover dispensers.
  11. Recessed trash receptacles.
  12. Robe hooks
  13. Mop and broom holder.

1.2 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.

1.3 QUALITY ASSURANCE

A. 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 the Contracting Officer.

1.4 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.
PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

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

1. Bobrick Washroom Equipment, Inc.
2. Bradley Corporation.

2.2 MATERIALS, GENERAL

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.

B. 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.

C. Galvanized Steel Sheet: ASTM A 527, G60.

D. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

E. Mirror Glass: Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated copper coating, and protective organic coating.


G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 PAPER TOWEL DISPENSER (CF/CI)

A. Georgia Pacific #59462 EnMotion Wall Mount Automated Touchless Towel Dispenser.

2.4 GRAB BARS (CF/CI)

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.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.

2.5 SANITARY NAPKIN DISPOSAL UNITS (CF/CI)

A. Bobrick #B-254 Surface Mount.

2.6 SOAP DISPENSERS (CF/CI)

A. Eco Lab Kay touch free dispenser.
2.7 MIRROR UNITS (CF/CI)
   A. Standard Stainless Steel Framed Mirror Units: Fabricate frame with channel shapes not less than 0.04 inch (20 gauge), with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430 bright polished finish.

2.8 CHILDCARE ACCESSORIES (CF/CI)
   A. Diaper Changing Station:
      1. “Koala Kare”; KB200-05; horizontal, wall mounted, white granite color.
   B. Diaper-pack vendor.
      1. “Koala Kare” KB143-SS, recessed.
   C. Child-protection seat.
      1. “Koala Kare” KB102-00, creame color, 150 lbs static weight.

2.9 TOILET TISSUE DISPENSERS (CF/CI)
   A. Georgia Pacific #56790 Compact Vertical Double Roll Coreless Tissue Dispenser.

2.10 FOLD DOWN PURSE SHELF (CF/CI)

2.12 SEAT COVER DISPENSER (CF/CI)
   A. Georgia Pacific #57710 Safe-T-Gard ½ Fold.

2.13 WASTE RECEPTACLE (CF/CI)
   A. Bobrick #B-43644 Contura Series Recessed Waste Receptacle with Liner Mate.

2.14 ROBE HOOKS (CF/CI)
   A. Product: Bobrick B-2116.
   B. One at each toilet compartment.

2.15. MOP AND BROOM HOLDER (CF/CI)
   A. Provide mop and broom holder complying with the following:
      1. Products: Bobrick B-223x36.
      2. Holder: 36-inch long unit fabricated of minimum nominal 1.2-mm- thick, stainless-steel hat channel with four spring-loaded, rubber, cam-type, mop/broom holders.
      3. Mounting Height: 54 inches above finished floor, centered over mop sinks.
      4. Location: Provide quantity 6 at each Janitor Room.

2.16. UNDERSINK PROTECTIVE PIPE COVERS (CF/CI)
   A. Provide molded cell vinyl covers at wheelchair accessible lavatory P-trap and angle valve assemblies. Covers shall be ADA conforming and antimicrobial:
1. **Products:** True Bro “Lavguard”.
2. **Nominal Wall Thickness:** 1/8”.
3. **Finish:** Smooth High Gloss.
4. **Color:** White.
5. **Thermal Conductivity:** 1.17 K plus dead air space.

### 2.17 FABRICATION

**A. General:** No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by 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 seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

**C. Recessed Toilet Accessories, General:** Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

**D. 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 nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

**E. Keys:** Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to AAFES' 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.

**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 lbf, 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 10 28 00
SECTION 10 44 13
FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets in non-rated walls for the following:
      a. Portable fire extinguishers.
   3. Fire-protection accessories.

1.2 SUBMITTALS
A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
   1. Fire Extinguishers: Include rating and classification.
   2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.
C. Samples for Verification: For each type of exposed cabinet finish required, prepared on Samples of size indicated below and of same thickness and material indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
   1. Size: 6-by-6-inch- (150-by-150-mm-) square Samples.

1.3 QUALITY ASSURANCE
A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide extinguishers listed and labeled by FM.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Portable Fire Extinguishers (Basis of Specification – Larsen's Manufacturing Co., Series "MP"):
   a. General Fire Extinguisher Corporation.
   b. J.L. Industries, Inc.
   c. Larsen's Manufacturing Company.

2. Fire-Protection Cabinets (Basis of Specification – Larsen's Manufacturing Co., "Architectural Series": (semi-recessed) AL 2409-6R; Fire Extinguisher Bracket No. 821; SC:
   a. General Accessory Manufacturing Co.
   b. J.L. Industries, Inc.
   c. Larsen's Manufacturing Company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   2. Extruded Shapes: ASTM B 221 (ASTM B 221M).

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated #10 ABC, 5-lb (2.3-kg) nominal capacity, in enameled-steel container.

C. Class K at Food Prep Areas. 6 liter.

2.4 FIRE-PROTECTION CABINETS

A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

B. Cabinet Type: Suitable for the following:
1. Fire extinguisher.

C. Cabinet Mounting: Suitable for the following mounting conditions:

1. Semirecessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated. RC-1 and RC-Rated.

D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   a. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.

E. Cabinet Trim Material: Aluminum.

F. Door Material: Aluminum.

G. Door Style: Manufacturer's standard design, as follows:

1. Solid opaque panel with frame.

H. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.

1. Provide minimum 1/2-inch- (13-mm-) thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.

I. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

2.5 ACCESSORIES

A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.

1. Provide brackets for extinguishers located in cabinets.

2. Provide wall brackets for extinguishers not located in cabinets.

B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to wall surface.
2. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.

2.6 COLORS AND TEXTURES

A. Colors and Textures: As indicated by referencing manufacturer's designations.
2.7 FINISHES, GENERAL
   A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
   C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES
   A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   B. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets are to be installed.
   B. Examine fire extinguishers for proper charging and tagging.
      1. Remove and replace damaged, defective, or undercharged units.
   C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION
   A. Comply with manufacturer's written instructions for installing fire-protection specialties.
   B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
      1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
      2. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION
   A. Adjust cabinet doors that do not swing or operate freely.
   B. Refinish or replace cabinets and doors damaged during installation.
C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 104413
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.

2. Material and Thickness: Brass, 0.032 inch stainless steel, 0.025 inch aluminum, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.

3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Brady Corporation.
   b. Brimar Industries, Inc.
   c. Carlton Industries, LP.
   d. Champion America.
   e. Craftmark Pipe Markers.
   f. emedco.
   g. Kolbi Pipe Marker Co.
   h. LEM Products Inc.
   i. Marking Services, Inc.

2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

3. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Brady Corporation.
2. Brimar Industries, Inc.
3. Carlton Industries, LP.
5. Craftmark Pipe Markers.
6. emedco.
7. LEM Products Inc.
8. Marking Services Inc.
10. Seton Identification Products.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.


D. Background Color: Red.

E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

G. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

H. Fasteners: Stainless-steel rivets or self-tapping screws.

I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
4. Carlton Industries, LP.
5. Champion America.
7. emedco.
8. Kolbi Pipe Marker Co.
9. LEM Products Inc.
10. Marking Services Inc.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 LABEL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install or permanently fasten labels on each major item of mechanical equipment.

D. Locate equipment labels where accessible and visible.

E. Piping: Painting of piping is specified in Section 099000 "Painting."

F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

END OF SECTION 210553
SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipes, fittings, and specialties.
   2. Sprinklers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For wet-pipe sprinkler systems.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which items of other systems and equipment are shown and coordinated with each other, using input from installers of the items involved.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

C. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer’s responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
   1. Sprinkler system design shall be approved by authorities having jurisdiction.
      a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
      b. Sprinkler Occupancy Hazard Classifications:
         1) General Storage Areas: Ordinary Hazard, Group 2.

2. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.

3. Maximum Protection Area per Sprinkler: According to UL listing.
   a. Storage Areas: 130 sq. ft..

C. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.


C. Malleable- or Ductile-Iron Unions: UL 860.

D. Grooved-Joint, Steel-Pipe Appurtenances:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Anvil International.


4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Anvil International.
   b. National Fittings, Inc.
   c. Tyco Fire & Building Products LP.


5. Type: Mechanical-tee and -cross fittings.

6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.

7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.

8. Branch Outlets: Grooved, plain-end pipe, or threaded.

2.4 SPRINKLERS

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

2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire & Building Products LP.
4. Victaulic Company.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Automatic Sprinklers with Heat-Responsive Element:
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

F. Sprinkler Finishes: Chrome plated bronze and painted.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat Chrome-plated steel, two piece, with 1-inch vertical adjustment Plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.

H. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Reliable Automatic Sprinkler Co., Inc. (The).
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
G. 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 ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

L. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

M. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

O. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.3 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.4 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.5 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
B. Identify system components, wiring, cabling, and terminals.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.7 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.8 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

D. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

E. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313
1.1 CONDITIONS AND REQUIREMENTS
A. Refer to BIDDING REQUIREMENTS, CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS and DIVISION 01 of these specifications, which govern work under DIVISION 23. Refer to other sections of these specifications for additional related requirements.

1.2 SCOPE OF REQUIREMENTS
A. The work covered by Division 22 of the specifications shall include but not be limited to:
   1. Furnishing all materials and supplying all labor, equipment and services to install the complete mechanical system as shown on the accompanied drawings and specified herein.

1.3 DESCRIPTION OF WORK
A. The contract documents including specifications and construction drawings are intended to provide all material and labor to install complete plumbing, heating ventilating and air conditioning systems for the building.
B. Every effort has been made on the design to meet or exceed the minimum requirements of the Codes; therefore, unless Contractor before signing his Contract, shall have notified the Architect, in writing, of any items in conflict with said Codes, he shall thereafter make any minor adjustments necessary to meet said Codes at no cost to the Owner.
C. The Contractor shall refer to the architectural interior detail, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the equipment and are not to be scaled; all dimensions shall be checked at the building.
D. The Contractor shall comply with the project close-out requirements as detailed in General Requirements of Division 01.

1.4 DESCRIPTION OF BID DOCUMENTS
A. Specifications:
   1. Specifications, in general, describe quality and character of materials and equipment.
   2. Specifications are of simplified form and include incomplete sentences.
B. Drawings:
   1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
   2. Scaled and figured dimensions are approximate and are for estimating purposes only.
   3. Before proceeding with work check and verify all dimensions.
4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.

5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible.

1.5 CODES PERMITS AND FEES
A. Mechanical work shall be in accordance with the following:
   1. Refer to the AAFES Prototype Design Guidelines for all applicable Code and Standards.
   2. The Contractor at his expense shall obtain permits and inspections required for the mechanical work on this project. Deliver all inspection certificates to the Owner’s Representative prior to final acceptance of the work.
   3. Contractor shall pay all costs levied by utility companies and/or governing agencies associated with gas connections and include these costs within his bid. This shall include but not be limited to tap fees, service mains, meter, and vault charges.

1.6 DEFINITIONS
A. The terms “The Contractor”, when used in Division 22 shall mean the Contractor for mechanical work.

B. The term “Owners Representative” as used in Division 22 generally refers to the Architect or his designated representative in accordance with the General Conditions.

C. The term “Provide” shall mean furnish and install.

1.7 TEMPORARY HEATING
A. See Section 015000 Temporary Facilities and Controls.

1.8 SAFETY AND PROTECTION
A. Safety Measures: The Engineer has not been retained to provide design and construction services relating to the Contractor’s safety precautions, or means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement applies continuously and is not limited to normal working hours. Provide all required safety measures and consult with the State or Federal safety inspector for interpretation whenever in doubt as to whether safe conditions do or do not exist or whether compliance with State or Federal regulations exist.

B. Head protection: Where pipe hangers, equipment support angles, etc., are exposed in access ways for any maintenance, cover all such potentially injurious protrusions less than 7’-0” above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

1.9 MECHANICAL COST BREAKDOWN
A. Cost breakdown not required.
1.10 GUARANTEE

A. The Mechanical equipment and installation shall be guaranteed for a period of one (1) year from the date of acceptance unless and individual item or specification is otherwise noted as longer. The Contractor shall make-good at his own expense all defects in his work, and/or equipment furnished by him, which shall develop at any time during the one year guarantee period and shall stand any expense of cutting and patching and repairing made necessary by his corrections of unsatisfactory work or equipment operation.

PART 2 - PRODUCTS

2.1 DUCTWORK AND PIPING COORDINATION

A. Prior to installation of the new Division 22 systems, the Contractor shall coordinate the proposed installation with the Architectural and Structural requirements, and all other trades (including HVAC, Plumbing, Fire Protection, Electrical, Ceiling Suspension and Tile systems), and provide reasonable maintenance access requirements.

B. Provide means of access to all valves, dampers, controllers, operable devices and other apparatus which may require adjustment or servicing.

C. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Owners Representative of any discrepancies between that indicated on the Drawings and that existing in the field prior to any installation. Contractor shall be responsible for all costs associated with the removal or relocation of installed systems that have been installed without prior notification of the Owners Representative.

2.2 SHOP DRAWINGS AND SUBMITTALS

A. Submit Shop Drawings and Product Data per the requirements of Section 013300 Submittals Procedures.

B. See individual Division 22 specification sections for additional submittal requirements.

C. Submittals of Product Data shall be bound in a black 3-ring binder with the project name on the cover. Data within this binder shall be arranged as follows:

1. Provide index tabs for each specification section in the same order and using the same name as appears in the Specifications.

2. Data shall be black and white, on 8 ½” x 11” or 11” x 17”, single, one-sided sheets suitable for copying. Diagrams and drawings larger than 11” x 17” shall be submitted in reproducible form (translucent bond paper).

3. Drawings and catalog data must be clean, neat copies. Fax material or other poor quality copies will not be acceptable.

D. If material or equipment is not as specified or submittal is not complete, it will be rejected. Only completed submittal including all applicable specification sections will be reviewed.

E. Indicate manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Indicate sizes, types, model numbers, ratings, capacities and options actually being proposed.
F. Include dimensional data for roughing in and installation, and technical data sufficient to confirm that equipment meets requirements of drawings and specifications.

G. Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.

H. Submit five (5) copies of each shop drawing. The Engineer will retain one stamped copy, one will be provided to the Architect, one will be provided to the owner and a two stamped copies will be returned to the Contractor. The Contractor shall be responsible for distribution of required number of reviewed copies to parties other than the Owner’s Representative(s).

2.3 RECORD DRAWINGS
A. Refer to Division 01.

B. Keep on site, an extra set of drawings and specifications recording changes and deviations daily. Return these drawings to the Owner’s Representative at the completion of the Project. These drawings shall not be used for any other purposes.

2.4 OPERATING AND MAINTENANCE MANUALS
A. Refer to Section 01770 Project Closeout.

B. See individual Division 23 specification sections for additional Operating and Maintenance Manual requirements.

2.5 OPERATION AND MAINTENANCE TRAINING/STARTUP
A. Instruct the Owners representative(s) in operation and maintenance of mechanical systems utilizing the Operation and Maintenance Manual.

B. Individuals present shall include Contractors, subcontractors and equipment factory representatives. These individuals shall assist in instruction and start-up.

C. Instruction period shall occur after final inspection when systems are properly working.

D. Prepare statement and check list to be included in the Operation and Maintenance Manual. This Statement shall read as follows:

“The Contractor, associated factory representatives and subcontractors, have started each system and the total system and have proved their normal operation to the Owner’s representative and have instructed him in the operation and maintenance thereof.”

Owner’s Representative Contractor

2.6 EQUIPMENT AND MATERIALS – STANDARDS/CODES
A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Each item of equipment shall conform to the latest Standard Specifications of the American Society for Testing Materials and shall conform to any applicable standards of the United States Department of Commerce.
B. Instruct the Owners representative(s) in operation and maintenance of mechanical systems utilizing the Operation and Maintenance Manual. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when the Project is turned over to the Owner.

C. All electrically driven or connected equipment shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC.

D. All control panels shall be provided with UL or equivalent Label and/or listing in accordance with the requirements of the NEC an applicable local codes.

2.7 EQUIPMENT/MATERIAL SUBSTITUTIONS
A. Refer to Section 012500 Substitution Procedures for product prior approval and substitution requirements.

B. Throughout these specifications and drawings, various materials, equipment, apparatus, etc., are specified or scheduled by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of design and the bid.

C. Submit proposals to supply alternative materials or equipment in writing, in accordance with Section 012500 Substitution Procedures.

D. Equipment manufacturers listed in individual sections are approved alternatives for this project and are subject to requirements of drawings and specifications. Revisions required to adapt alternatives shall be the responsibility of the Contractor.

E. Products furnished other than the (basis of design) shall have similar electrical characteristics as the scheduled or specified equipment. Contractor shall be responsible for any electrical changes caused by products not in accordance with this requirement.

2.8 EQUIPMENT PROTECTION AND CLEAN-UP
A. Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts and duct systems.

B. Protect equipment with polyethylene covers and crates.

C. Operate, drain and flush bearings and refill with change of lubricant before final acceptance.

D. Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Provide extended nipples for lubrication.

E. Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.

PART 3 - EXECUTION

3.1 LOCATIONS
A. Coordination of Division 22 equipment and systems to the available space, with other trades. The access routes through the construction shall be the Contractor’s responsibility.
B. Drawings are diagrammatic. Make offsets, transitions, and changes in direction of pipes and ducts, as required to maintain proper headroom and pitch of sloping lines and avoid structural, electrical, pipe and duct interference’s whether or not indicated on Drawings. Furnish fittings, etc., as required to make these offsets, transitions and changes in direction at no additional cost to the Owner.

C. Determine exact route and location of ducts and coordinate and obtain approval for changes from the layout indicated on the drawings with the Owner’s Representative prior to fabrication.

D. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Verify the physical dimensions of each item of mechanical equipment to fit the available space and promptly notify the Owner’s Representative prior to roughing-in if conflicts appear.

E. All wiring, equipment, ductwork, tubing, etc., shall be concealed within building construction unless otherwise noted, or in mechanical rooms.

F. Arrange ducts, and equipment to permit ready access to starters, motors, control components, and to clear openings of doors and access panels.

3.2 CUTTING AND PATCHING

A. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 22 shall be the responsibility of the Division 23 Contractor. All cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.

B. Patch and repair walls, floors, ceilings and roof with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner’s Representative.

C. All cutting and patching made necessary to repair defective equipment, defective workmanship or be neglect of this Contractor to properly anticipate his requirements shall be included in Division 23.

D. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative’s written approval.

E. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under this Division is responsibility of Division 23.

3.3 SCHEDULING

A. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner’s Representative. Should conditions arise where certain changes would be advisable, secure approval from Owner’s Representative for those changes before proceeding with work.

B. Coordinate with the work of various trades when installing interrelated work. Before installation of mechanical items, make proper provision to avoid interference’s. Changes required in work specified in Division 22 caused by neglect to do so shall be made at no cost to Owner.
C. Furnish and install inserts and supports required by Division 23 unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 23.

3.4 EXISTING UTILITIES

A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a Ten foot (10') radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Owner’s Representative for a decision before proceeding or may proceed at his own expense.

B. Connection points to existing work shall be located and verified prior to starting new work.

C. Prior to commencing any excavation or ditching activity, the Contractor shall verify the exact location and inverts of all existing utilities and connection points in the area of his proposed excavation. Notify Owner’s representative for further direction if actual inverts will not allow the proper installation of new work.

D. The Contractor shall be responsible for damages, which might be caused by his failure to exactly locate and preserve underground utilities.

3.5 PHASING AND SEQUENCE OF WORK

A. Contractor shall be aware that this is a remodel project. There will be occupied areas in the construction areas that must remain operable.

B. Work shall be bid to allow for the remodel nature of this project and the concurrent occupied areas.

C. All systems shall be fully operational to the extent that they are installed at the termination of each phase of the work.

D. System passing through existing, future, or other phase areas shall be installed, if required, to make work installed under the current phase operational.

E. All connections to and disconnection’s from existing utilities shall be coordinated with and approved by the Owner prior to proceeding with the work. Work shall be planned so as to minimize impact to areas not involved in ongoing construction. Where areas not involved in ongoing construction are to be impacted, the contractor shall identify such areas, the extent to which they will be affected and the period of time for which they will be affected. The contractor is advised that the above notification and scheduling requirement may necessitate rescheduling, partial completion and reconnection, overtime work at night or on weekends or delay of the work. Contractor costs incurred due to the above shall be included in the original bid price and shall not be the cause for additional claims or charges to the Owner.

3.6 ASBESTOS CONTROL

A. Specific attention is directed to the potential of asbestos bearing compounds and materials on the project. Careful coordination with other Contractors and reasonable care shall be exercised.
1. If other asbestos bearing or other hazardous compounds are encountered during the course of construction, the Contractor shall immediately notify the Owner who will take appropriate action to have the asbestos removed.

3.7 PROJECT FINALIZATION & STARTUP

A. Upon completion of the equipment and systems installation and connections, the Contractor shall assemble all major equipment factory representatives (Exhaust fans) and subcontractors together for system start-up and Owner instructional period.

B. These individuals shall assist in start-up and check out of their systems and shall remain at the site until the system operation is acceptable and understood to the Owner's maintenance and/or operation personnel.

C. To provide acceptance of operation and instruction by the Owner's representative, the Contractor shall prepare a written statement of acceptance explaining same for the Owner's signature.

The statement should read as follows:

"I, the Contractor, associated factory representative and subcontractor, have started each system and the total system and have proved their normal operation to the Owner's representative and have instructed him in the operation and maintenance thereof."

_________________________  _________________________
Owner's Representative       Contractor

D. Copies of this acceptance shall be sent to the Engineer and the Architect and one copy shall be put in each maintenance manual.

3.8 PUNCH LIST PROCEDURES

A. The Contractor shall notify the Owner’s Representative in wiring when the project is ready for punch lists. After punch lists are complete, written notice must be forwarded to the Owner’s Representative requesting final checkout.

B. At the time of final observation, the project foreman shall accompany the observation party and shall remove access panels as required, to allow complete observation of the entire mechanical system.

END OF SECTION 22 00 00
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeves.
4. Escutcheons.
5. Plumbing demolition.
6. Equipment installation requirements common to equipment sections.
7. Supports and anchorages.
8. Access doors.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. 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.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
1.5 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

1.6 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.

E. Welding Filler Metals: Comply with AWS D10.12.

1.7 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1.8 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
1.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

1.10 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section 07 84 13 "Penetration Firestopping" for materials.
O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

1.11 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.


F. 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 ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

1.12 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

1.13 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

1.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

1.15 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

1.16 ACCESS DOORS

A. Access doors to match surrounding surface, provided with recess to accept matching finish. Provide UL rated doors in fire rated construction.

B. Provide 12”x12” access doors for maintenance or adjustments purposes for all mechanical system components including valves, volume dampers, fire dampers, fire/smoke dampers, clean outs, traps and controls.

END OF SECTION 23 05 00
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   4. Bronze swing check valves.
   5. Iron swing check valves.
   6. Chainwheels.

B. Related Sections:
   1. Division 22 Plumbing piping Sections for specialty valves applicable to those Sections only.

1.2 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.3 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to Plumbing valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Gear Actuator: For quarter-turn valves NPS 8 (DN 200) and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.

E. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:

1. Gate Valves: With rising stem.
2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. Two-Piece, Regular-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Description:
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Brass or bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Stainless steel.
   i. Ball: Stainless steel, vented.
   j. Port: Regular.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.
   i. Ball: Chrome-plated brass.
   j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

C. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Description:

b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Regular.

D. Two-Piece, Regular-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Description:

b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Regular.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
e. Seat: EPDM.
f. Stem: One- or two-piece stainless steel.
B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
   e. Seat: EPDM.
   f. Stem: One- or two-piece stainless steel.
   g. Disc: Nickel-plated or -coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Description:
   a. Standard: MSS SP-67, Type I.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
   d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
   e. Seat: EPDM.
   f. Stem: One- or two-piece stainless steel.
   g. Disc: Stainless steel.

2.5 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:
   a. Standard: MSS SP-80, Type 3.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   e. Ends: Threaded.
   f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:
   a. Standard: MSS SP-80, Type 4.
   b. CWP Rating: 200 psig (1380 kPa).
   c. Body Design: Horizontal flow.
   e. Ends: Threaded.
   f. Disc: PTFE or TFE.
2.6 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:

1. Description:
   a. Standard: MSS SP-71, Type I.
   b. NPS 2-1/2 to NPS 12 (DN 65 to DN 300), CWP Rating: 200 psig (1380 kPa).
   c. NPS 14 to NPS 24 (DN 350 to DN 600), CWP Rating: 150 psig (1035 kPa).
   d. Body Design: Clear or full waterway.
   e. Body Material: ASTM A 126, gray iron with bolted bonnet.
   f. Ends: Flanged.
   g. Trim: Composition.
   h. Seat Ring: Bronze.
   i. Disc Holder: Bronze.
   j. Disc: PTFE or TFE.
   k. Gasket: Asbestos free.

2.7 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
2. Attachment: For connection to butterfly valve stems.
3. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve. Include zinc coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior 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. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for butterfly valves NPS 4 (DN 100) and larger and more than 96 inches (2400 mm) above floor. Extend chains to 60 inches (1520 mm) above finished floor.

F. Install swing check valves for proper direction of flow and in horizontal position with hinge pin level.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly valves.

2. Throttling Service, Except Steam: Ball or butterfly valves.

3. Pump-Discharge Check Valves:
   a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
   b. NPS 2-1/2 (DN 65) and Larger: Iron swing check valves with spring.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.

4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.

2. Ball Valves: One or Two piece, regular port, brass or bronze with bronze trim.

3. Bronze Swing Check Valves: Class 125, nonmetallic disc..

B. Pipe NPS 2-1/2 (DN 65) and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 50 to NPS 100): May be provided with threaded ends instead of flanged ends.
3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:
   1. Bronze or Brass Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: One or Two piece, regular port, brass or bronze with bronze trim.
   3. Bronze Swing Check Valves: Class 125, nonmetallic disc.

B. Pipe NPS 2-1/2 (DN 65) and Larger:
   1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100): May be provided with threaded ends instead of flanged ends.
   3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
   4. Iron Swing Check Valves with Closure Control: Class 125, lever and weight.
SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Equipment supports.

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. See Division 21 Section "Wet-Pipe Sprinkler Systems" for pipe hangers for fire-protection piping.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details for the following:
   1. Trapeze pipe hangers. Include Product Data for components.
   2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping: ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb (340 kg).
   b. Medium (MSS Type 32): 1500 lb (680 kg).
   c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


H. Install hangers and supports to allow controlled thermal and seismic 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Install building attachments in accordance with limitations of structure as per the structural design and component limitations. Do not suspend piping, ductwork or equipment directly off of bare metal roof decking. Provide appropriate cross-bracing as necessary. Do not use eccentric beam clamps on metal bare joists, instead use concentric hangers or bolt through center section.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
      b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
      c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
      d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
      e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.
   5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

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 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

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

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 05 29
SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.

1.2 SUBMITTAL
A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS
A. Metal Labels for Equipment:
   1. Material and Thickness: Anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
   3. Background Color: Black or blue.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.


C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.
PART 3 - EXECUTION

3.1 PREPARATION
A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION
A. Install or permanently fasten labels on each major item of mechanical equipment.
B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION
A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting
B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 15 feet (3.8 m) in areas of congested piping and equipment.

3.4 DUCT LABEL INSTALLATION
A. Install plastic-laminated or self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
   1. Blue: For cold-air supply ducts.
   2. Yellow: For hot-air supply ducts.
   4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system. Do not label ducts that are exposed to view in finished spaces without ceilings.

END OF SECTION 22 05 53
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Specialty valves.
3. Flexible connectors.
4. Water meters furnished by utility company for installation by Contractor.
5. Water meters.
7. Sleeves and sleeve seals.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE7.

1.3 SUBMITTALS

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

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.

C. Comply with NSF 61 for potable domestic water piping and components.
PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
   4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
   5. Copper Pressure-Seal-Joint Fittings:
      a. NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
      b. NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed temper.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
   2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B, Standard Weight. Include ends matching joining method.
2.5 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.6 SPECIALTY VALVES

A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.

B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

2.7 TRANSITION FITTINGS

A. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

B. Sleeve-Type Transition Coupling: AWWA C219.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:
   1. Description:
      a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
      b. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Description:
      a. Factory-fabricated, bolted, companion-flange assembly.
      b. Pressure Rating: 150 psig (1035 kPa).
      c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:
   1. Description:
a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig (1035 kPa).
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Description:

   a. Galvanized-steel coupling.
   b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
   c. End Connections: Female threaded.
   d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Description:

   a. Electroplated steel nipple complying with ASTM F 1545.
   b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
   c. End Connections: Male threaded or grooved.
   d. Lining: Inert and noncorrosive, propylene.

2.9 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.10 WATER METERS

A. Displacement-Type Water Meters:

1. Description:

   b. Pressure Rating: 150-psig (1035-kPa) working pressure.
   c. Body Design: Nutating disc; totalization meter.
   d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility.
   e. Case: Bronze.
   f. End Connections: Threaded.
B. Compound-Type Water Meters:

   1. Description:
      b. Pressure Rating: 150-psig (1035-kPa) working pressure.
      c. Body Design: With integral mainline and bypass meters; totalization meter.
      d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
      e. Case: Bronze.

   C. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

2.11 ESCUTCHEONS

   A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
   
   B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.


   D. One Piece, Stamped Steel: Chrome-plated finish with setscrew or spring clips.

   E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

   F. Split Plate, Stamped Steel: Chrome-plated finish with concealed or exposed-rivet hinge, setscrew or spring clips.

   G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

   H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.12 SLEEVES

   A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

   B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

   C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

   D. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.

   E. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

      1. Underdeck Clamp: Clamping ring with setscrews.
2.13 SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
   
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.14 GROUT


B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping adjacent to equipment and specialties to allow service and maintenance.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump.

S. Install thermometers on outlet piping from each water heater.

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. 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 ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
3.3 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 (DN 50) and smaller. Use butterfly or gate valves for piping NPS 2-1/2 (DN 65) and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50) and smaller and butterfly valves for piping NPS 2-1/2 (DN 65) and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
   1. NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
   2. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller:

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.

D. Dielectric Fittings for NPS 5 to NPS 6 (DN 125 to DN 150): Use dielectric flange kits.

3.6 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.
3.7 WATER METER INSTALLATION

A. Rough-in domestic water piping and install water meters according to utility company's requirements.

B. Water meters will be furnished and installed by utility company.

C. Install water meters according to AWWA M6, utility company's requirements, and the following:

D. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

E. Install compound-type water meters with shutoff valves on water-meter inlet and outlet and on valved bypass around meter. Support meters, valves, and piping on brick or concrete piers.

F. Install remote registration system according to standards of utility company and of authorities having jurisdiction.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
3. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

E. Install supports for vertical copper tubing every 10 feet (3 m).

F. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4 (DN 32) and Smaller: 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
5. NPS 3 and NPS 3-1/2 (DN 80 and DN 90): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

G. Install supports for vertical steel piping every 15 feet (4.5 m).
H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer’s written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to equipment and machines to allow service and maintenance.
C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
   4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

3.10 ESCUTCHEON INSTALLATION

A. Install escutcheons for penetrations of walls, ceilings, and floors.
B. Escutcheons for New Piping:
   1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
   2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
   3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
   4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
   5. Bare Piping in Equipment Rooms: One piece, cast brass.
   6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

3.11 SLEEVE INSTALLATION

A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
B. Sleeves are not required for core-drilled holes.
C. Permanent sleeves are not required for holes formed by removable PE sleeves.

D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.

E. Install sleeves in new partitions, slabs, and walls as they are built.

F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.

H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.

I. Seal space outside of sleeves in concrete slabs and walls with grout.

J. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.

K. Install sleeve materials according to the following applications:

   1. Sleeves for Piping Passing through Concrete Floor Slabs: Steel pipe.
   2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe.
      a. Extend sleeves 2 inches (50 mm) above finished floor level.
      b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
   3. Sleeves for Piping Passing through Gypsum-Board Partitions:
      a. Steel pipe sleeves for pipes smaller than NPS 6 (DN 150).
      b. Galvanized-steel sheet sleeves for pipes NPS 6 (DN 150) and larger.
      c. Exception: Sleeves are not required for water supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
   4. Sleeves for Piping Passing through Concrete Roof Slabs: Steel pipe.
   5. Sleeves for Piping Passing through Exterior Concrete Walls:
      a. Steel pipe sleeves for pipes smaller than NPS 6 (DN 150).
      b. Cast-iron wall pipe sleeves for pipes NPS 6 (DN 150) and larger.
      c. Install sleeves that are large enough to provide 1-inch (25-mm) annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.
3.12 SLEEVE SEAL INSTALLATION

A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.

B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.13 IDENTIFICATION

A. Identify system components.

B. Label pressure piping with system operating pressure.

3.14 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:
   1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
   2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
      b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

   3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
   4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:
   1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
   6. Prepare reports for tests and for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.
3.15 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
   d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.16 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building service piping, PS 3 (DN 80) and smaller, shall be the following:

   1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper solder-joint fittings; and brazed.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 6 (DN 100 to DN 150), shall be one of the following:

   1. Push-on-joint, ductile-iron pipe; standard or compact-pattern push-on-joint fittings; and gasketed joints.
   2. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

E. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:

   1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) copper solder-joint fittings; and soldered joints.
3. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 6 (DN 65 to DN 150) shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); cast or wrought copper solder-joint fittings; and brazed joints.
2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
4. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

3.17 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
5. Temperature-actuated water mixing valves.
7. Hose bibbs.
8. Wall hydrants.
10. Water hammer arresters.
11. Trap-seal primer valves.

B. See Division 22 Section "Domestic Water Piping" for water meters.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. NSF Compliance:

2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers
   2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
   4. Inlet and Outlet Connections: Threaded.
   5. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers
   2. Body: Bronze, nonremovable, with manual drain.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers
   1. Standard: ASSE 1012.
   2. Operation: Continuous-pressure applications.
   5. End Connections: Union, solder joint.
   6. Finish: Chrome plated.

B. Reduced-Pressure-Principle Backflow
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: 12 psig (83 kPa) maximum, through middle 1/3 of flow range.
   4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or steel with interior lining complying with AWWA C550 or that is FDA approved, or stainless steel for NPS 2-1/2 (DN 65) and larger.
   5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
   6. Accessories:
      a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

C. Double-Check Backflow-Prevention Assemblies
   2. Operation: Continuous-pressure applications, unless otherwise indicated.
   3. Pressure Loss: 5 psig (35 kPa) maximum, through middle 1/3 of flow range.
4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or steel with interior lining complying with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 (DN 65) and larger.

5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

6. Accessories:
   a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

D. Backflow-Preventer Test Kits
   1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators
   2. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
   3. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
   5. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

2.4 BALANCING VALVES

A. Memory-Stop Balancing
   2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
   3. Size: NPS 2 (DN 50) or smaller.
   4. Body: Copper alloy.
   5. Port: Standard or full port.
   7. Seats and Seals: Replaceable.
   8. End Connections: Solder joint or threaded.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices
   3. Type: Thermostatically controlled water mixing valve.
   5. Connections: Threaded union inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing

3. Type: Exposed-mounting or Cabinet-type, thermostatically controlled water mixing valve.
5. Connections: Threaded union inlets and outlet.
6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Valve Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
8. Valve Finish: Rough bronze.
10. Cabinet: Factory-fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers

1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm).
   b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm).
   c. Strainers NPS 5 (DN 125) and Larger: 0.10 inch (2.54 mm).

2.7 HOSE BIBBS

A. Hose Bibbs

4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants

3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounting with cover.
8. Box and Cover Finish: Polished nickel bronze or Chrome plated.
11. Operating Keys(s): One with each wall hydrant.

B. Moderate-Climate Wall Hydrants

3. Operation: Loose key.
4. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25).
5. Outlet: Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 and garden-hose thread complying with ASME B1.20.7.
9. Operating Keys(s): One with each wall hydrant.

C. Vacuum Breaker Wall

1. Standard: ASSE 1019, Type A or Type B.
2. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
3. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Operation: Wheel handle.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
8. Inlet: Threaded or solder joint.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer

2. Type: Metal bellows or Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves

2. Pressure Rating: 125 psig (860 kPa) minimum.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve, and pump.

G. Install water hammer arresters in water piping according to PDI-WH 201.

H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

I. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Intermediate atmospheric-vent backflow preventers.
   2. Reduced-pressure-principle backflow preventers.
   5. Primary, thermostatic, water mixing valves.

K. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:
   1. Test each reduced-pressure-principle backflow preventer and double-check backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.3 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 11 19
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
   1. Pipe, tube, and fittings.
   2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS
A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1.3 SUBMITTALS
A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE
A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS
B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.
   1. Sovent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
   2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
      a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
C. **Steel Pipe:** ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

1. **Drainage Fittings:** ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
2. **Pressure Fittings:**
   a. **Steel Pipe Nipples:** ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
   b. **Malleable-Iron Unions:** ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
   c. **Gray-Iron, Threaded Fittings:** ASME B16.4, Class 125, galvanized, standard pattern.
   d. **Cast-Iron Flanges:** ASME B16.1, Class 125.
   e. **Cast-Iron, Flanged Fittings:** ASME B16.1, Class 125, galvanized.

D. **Copper DWV Tube:** ASTM B 306, drainage tube, drawn temper.

1. **Copper Drainage Fittings:** ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

E. **Solid-Wall ABS Pipe:** ASTM D 2661, Schedule 40, solid wall.

1. **ABS Socket Fittings:** ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

F. **Solid-Wall PVC Pipe:** ASTM D 2665, solid-wall drain, waste, and vent.

1. **PVC Socket Fittings:** ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

PART 3 - EXECUTION

3.1 **PIPING APPLICATIONS**

A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.

B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

C. Aboveground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Copper DWV tube, copper drainage fittings, and soldered joints.

D. Aboveground, soil, waste, and vent piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. Steel pipe, drainage fittings, and threaded joints.
4. Copper DWV tube, copper drainage fittings, and soldered joints.
E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:

1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, soil and waste Piping NPS 5 (DN 125) and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.2 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Common Work Results for Plumbing."

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Common Work Results for Plumbing."

E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

J. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

L. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."


1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
2. Hubless Joints: Make with rubber gasket and sleeve or clamp.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

3.4 VALVE INSTALLATION

A. General-duty valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.

1. Use gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
2. Use butterfly valve for piping NPS 2-1/2 (DN 65) and larger.

C. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valves are specified in Division 22 Section "Sanitary Waste Piping Specialties."
3.5 HANGER AND SUPPORT INSTALLATION

A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:
   a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet (30 m), if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
   4. NPS 6 (DN 150): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.
   5. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

   1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
   4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
   5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
   6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
   7. NPS 6 (DN 150): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.

H. Install supports for vertical steel piping every 15 feet (4.5 m).

I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

   1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
   2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm) rod.
   3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   4. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

J. Install supports for vertical copper tubing every 10 feet (3 m).

K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer’s written instructions.

3.6 CONNECTIONS

A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

B. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Sanitary Waste Piping Specialties."
   4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
   1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   2. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.
3.9 PROTECTION

A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION 22 13 16
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes the following sanitary drainage piping specialties:
   1. Backwater valves.
   2. Cleanouts.
   3. Floor drains.
   4. Roof flashing assemblies.
   5. Miscellaneous sanitary drainage piping specialties.
   6. Flashing materials.
   7. Grease interceptors.

1.2 SUBMITTALS
A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE
A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES
A. Horizontal, Cast-Iron Backwater
   2. Size: Same as connected piping.
   4. Cover: Cast iron with bolted or threaded access check valve.
   5. End Connections: Hub and spigot or hubless.
   6. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
   7. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves
   1. Size: Same as floor drain outlet.
   2. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
   3. Check Valve: Removable ball float.
4. Inlet: Threaded.
5. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts
1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping.
3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts
1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Closure: Brass plug with straight threads and gasket.
6. Adjustable Housing Material: Cast iron with threads.
8. Frame and Cover Shape: Round.
10. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts
1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains
2. Pattern: Area, Floor, Funnel floor or Sanitary drain.
5. Sediment Bucket: Required on sanitary drains.
6. Top or Strainer Material: Nickel bronze.
7. Top of Body and Strainer Finish: Nickel bronze or Polished bronze.
8. Top Shape: Round for floor drains, Square for sanitary drains.
9. Dimensions of Top or Strainer: Grated strainer, or partial strainer for sanitary drains.
10. Top Loading Classification: Heavy Duty.
11. Trap Material: Cast iron.

2.4 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies

B. Description: Manufactured assembly made of 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch-(1.6-mm-) thick, lead flashing collar and skirt extending at least 6 inches (150 mm) from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.


2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
   a. NPS 2 (DN 50): 4-inch-(100-mm-) minimum water seal.
   b. NPS 2-1/2 (DN 65) and Larger: 5-inch-(125-mm-) minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

D. Air-Gap Fittings

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that
will extend 2 inches (51 mm) above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.

2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings

1. Description: Counterflash-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.6 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.7 GREASE INTERCEPTORS

A. Grease Interceptors – Fabricated Type

2. Plumbing and Drainage Institute Seal: Required.
3. Body Material: Cast iron or steel.
4. Interior Lining: Corrosion-resistant enamel.
5. Exterior Coating: Corrosion-resistant enamel.
6. Cleanout: Integral or field installed on outlet.
7. Mounting: Above floor or Recessed in acid-resistant, coated steel frame and cradle or Recessed, flush with floor.
8. Flow-Control Fitting: Required.

B. Grease Interceptors – Exterior Concrete Vault Type
1. Exterior concrete vault type, for intercepting and retaining fats, oils, and greases from food-preparation wastewater.
2. As detailed on the Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.
   4. Locate at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
   1. Position floor drains for easy access and maintenance.
   2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
      a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4-inch (6.35-mm) total depression.
      b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.
      c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression.
   3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
   4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.
J. Install deep-seal traps on floor drains and other waste outlets, if indicated.

K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

N. Install vent caps on each vent pipe passing through roof.

O. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
   2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
   3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
   4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
   1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.

3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Faucets for sinks.
2. Dishwasher air-gap fittings.
3. Disposers.
4. Hot-water dispensers.

1.2 DEFINITIONS

B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
C. FRP: Fiberglass-reinforced plastic.
D. PMMA: Polymethyl methacrylate (acrylic) plastic.
E. PVC: Polyvinyl chloride plastic.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessorys: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.


D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
4. Porcelain-Enamel, Formed-Steel Fixtures: ASME A112.19.4M.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
5. Hose-Connection Vacuum Breakers: ASSE 1011.

H. Comply with the following applicable standards and other requirements specified for shower faucets:

1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.

I. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

2. Brass and Copper Supplies: ASME A112.18.1.

J. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Disposers: ASSE 1008 and UL 430.
6. Off-Floor Fixture Supports: ASME A112.6.1M.

PART 2 - PRODUCTS

2.1 LAVATORY FAUCETS

A. Lavatory Faucets – Sensor Operated - Hardwired

1. Description: Sensor operated, hardwired, Single-control mixing valve. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

2.2 SINK FAUCETS

A. Sink Faucets:

1. Description: Kitchen faucet type with spray, four-hole fixture. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.

2.3 FLUSHOMETERS

A. Flushometers – Sensor Operated – Hardwired

1. Description: Flushometer for urinal or water-closet-type fixture. Sensor operated, hardwired. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.

   a. Dual Flush Design for Water Closets

2.4 TOILET SEATS

1. Description: Toilet seat for water-closet-type fixture.

   a. Material: Molded, solid plastic.
b. Configuration: Open front without cover.
c. Size: Elongated.
d. Hinge Type: SS, self-sustaining.
e. Class: Standard commercial.

2.5 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers, <Insert drawing designation>:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

2.6 FIXTURE SUPPORTS

A. Water-Closet Supports:

1. Description: Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

B. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.

2.7 SINKS

A. Sinks

1. Description: One, Two or Three-bowl, commercial, counter-mounting stainless-steel sink.
   a. Metal Thickness: 0.050 inch (1.3 mm).

   b. Sink Faucet;
   c. Supplies: NPS 1/2 (DN 15) chrome-plated copper with stops.
   d. Drain Piping: NPS 1-1/2 (DN 40) chrome-plated, cast-brass P-trap; 0.045-inch- (1.1-mm-) thick tubular brass waste to wall; and wall escutcheon(s).

2.8 SERVICE SINKS

A. Service Sinks

1. Description: Trap-standard- and wall-mounting, enameled, cast-iron fixture with roll-rim with plain or two faucet holes in back and rim guard on front and sides.
   b. Faucet: Sink.
c. Drain: Grid with NPS 3 (DN 80) outlet.
d. Fixture Support: Sink.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
   1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
   2. Use carrier supports without waste fitting for fixtures with tubular waste piping.

C. Install fixtures level and plumb according to roughing-in drawings.

D. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

E. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

F. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

G. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

H. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.

I. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

J. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

K. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

L. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

C. Ground equipment.

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.

B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00
SECTION 23 00 00

HVAC – GENERAL PROVISIONS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to BIDDING REQUIREMENTS, CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS and DIVISION 01 of these specifications, which govern work under DIVISION 23. Refer to other sections of these specifications for additional related requirements.

1.2 SCOPE OF REQUIREMENTS

A. The work covered by Division 23 of the specifications shall include but not be limited to:
   1. Furnishing all materials and supplying all labor, equipment and services to install the complete mechanical system as shown on the accompanied drawings and specified herein.

1.3 DESCRIPTION OF WORK

A. The contract documents including specifications and construction drawings are intended to provide all material and labor to install complete plumbing, heating ventilating and air conditioning systems for the building.

B. Every effort has been made on the design to meet or exceed the minimum requirements of the Codes; therefore, unless Contractor before signing his Contract, shall have notified the Architect, in writing, of any items in conflict with said Codes, he shall thereafter make any minor adjustments necessary to meet said Codes at no cost to the Owner.

C. The Contractor shall refer to the architectural interior detail, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the equipment and are not to be scaled; all dimensions shall be checked at the building.

D. The Contractor shall comply with the project close-out requirements as detailed in General Requirements of Division 01.

1.4 DESCRIPTION OF BID DOCUMENTS

A. Specifications:
   1. Specifications, in general, describe quality and character of materials and equipment.
   2. Specifications are of simplified form and include incomplete sentences.

B. Drawings:
   1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
   2. Scaled and figured dimensions are approximate and are for estimating purposes only.
   3. Before proceeding with work check and verify all dimensions.
   4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.

6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible.

1.5 CODES PERMITS AND FEES

A. Mechanical work shall be in accordance with the following:
   1. Refer to the AAFES Prototype Design Guidelines for all applicable Code and Standards.
   2. The Contractor at his expense shall obtain permits and inspections required for the mechanical work on this project. Deliver all inspection certificates to the Owner’s Representative prior to final acceptance of the work.
   3. Contractor shall pay all costs levied by utility companies and/or governing agencies associated with gas connections and include these costs within his bid. This shall include but not be limited to tap fees, service mains, meter, and vault charges.

1.6 DEFINITIONS

A. The terms “The Contractor”, when used in Division 23 shall mean the Contractor for mechanical work.

B. The term “Owners Representative” as used in Division 23 generally refers to the Architect or his designated representative in accordance with the General Conditions.

C. The term “Provide” shall mean furnish and install.

1.7 TEMPORARY HEATING

A. See Section 015000 Temporary Facilities and Controls.

1.8 SAFETY AND PROTECTION

A. Safety Measures: The Engineer has not been retained to provide design and construction services relating to the Contractor’s safety precautions, or means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement applies continuously and is not limited to normal working hours. Provide all required safety measures and consult with the State or Federal safety inspector for interpretation whenever in doubt as to whether safe conditions do or do not exist or whether compliance with State or Federal regulations exist.

B. Head protection: Where pipe hangers, equipment support angles, etc., are exposed in access ways for any maintenance, cover all such potentially injurious protrusions less than 7’-0” above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

1.9 GUARANTEE

A. The Mechanical equipment and installation shall be guaranteed for a period of one (1) year from the date of acceptance unless and individual item or specification is otherwise noted as longer. The Contractor shall make-good at his own expense all defects in his work, and/or equipment furnished by him, which shall develop at any time during the one year guarantee period and shall
stand any expense of cutting and patching and repairing made necessary by his corrections of unsatisfactory work or equipment operation.

1.10 DUCTWORK AND PIPING COORDINATION

A. Prior to installation of the new Division 23 systems, the Contractor shall coordinate the proposed installation with the Architectural and Structural requirements, and all other trades (including HVAC, Plumbing, Fire Protection, Electrical, Ceiling Suspension and Tile systems), and provide reasonable maintenance access requirements.

B. Provide means of access to all valves, dampers, controllers, operable devices and other apparatus which may require adjustment or servicing.

C. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Owners Representative of any discrepancies between that indicated on the Drawings and that existing in the field prior to any installation. Contractor shall be responsible for all costs associated with the removal or relocation of installed systems that have been installed without prior notification of the Owners Representative.

1.11 SHOP DRAWINGS AND SUBMITTALS

A. Submit Shop Drawings and Product Data per the requirements of Section 013300 Submittals Procedures.

B. See individual Division 23 specification sections for additional submittal requirements.

C. Submittals of Product Data shall be bound in a black 3-ring binder with the project name on the cover. Data within this binder shall be arranged as follows:
   1. Provide index tabs for each specification section in the same order and using the same name as appears in the Specifications.
   2. Data shall be black and white, on 8 ½” x 11” or 11” x 17”, single, one-sided sheets suitable for copying. Diagrams and drawings larger than 11” x 17” shall be submitted in reproducible form (translucent bond paper).
   3. Drawings and catalog data must be clean, neat copies. Fax material or other poor quality copies will not be acceptable.

D. If material or equipment is not as specified or submittal is not complete, it will be rejected. Only completed submittal including all applicable specification sections will be reviewed.

E. Indicate manufacturer, trade name and model number. Include copies of applicable brochure or catalogue material. Indicate sizes, types, model numbers, ratings, capacities and options actually being proposed.

F. Include dimensional data for roughing in and installation, and technical data sufficient to confirm that equipment meets requirements of drawings and specifications.

G. Include wiring, piping and service connection data, motor sizes complete with voltage ratings and schedules.

H. Submit five (5) copies of each shop drawing. The Engineer will retain one stamped copy, one will be provided to the Architect, one will be provided to the owner and a two stamped copies will be returned to the Contractor. The Contractor shall be responsible for distribution of reviewed copies to parties other than the Owner’s Representative(s).
I. LEED Submittals

1. Provide LEED submittals for refrigerants, filtration, adhesives and sealants.

1.12 RECORD DRAWINGS
A. Refer to Division 01.
B. Keep on site, an extra set of drawings and specifications recording changes and deviations daily. Return these drawings to the Owner’s Representative at the completion of the Project. These drawings shall not be used for any other purposes.

1.13 OPERATING AND MAINTENANCE MANUALS
A. Refer to Section 017700 Project Closeout.
B. See individual Division 23 specification sections for additional Operating and Maintenance Manual requirements.

1.14 OPERATION AND MAINTENANCE TRAINING/STARTUP
A. Instruct the Owners representative(s) in operation and maintenance of mechanical systems utilizing the Operation and Maintenance Manual.
B. Individuals present shall include Contractors, subcontractors and equipment factory representatives. These individuals shall assist in instruction and start-up.
C. Instruction period shall occur after final inspection when systems are properly working.
D. Prepare statement and check list to be included in the Operation and Maintenance Manual. This Statement shall read as follows:
   “The Contractor, associated factory representatives and subcontractors, have started each system and the total system and have proved their normal operation to the Owner’s representative and have instructed him in the operation and maintenance thereof.”

Owner’s Representative  Contractor

1.15 EQUIPMENT AND MATERIALS – STANDARDS/CODES
A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Each item of equipment shall conform to the latest Standard Specifications of the American Society for Testing Materials and shall conform to any applicable standards of the United States Department of Commerce.
B. Instruct the Owners representative(s) in operation and maintenance of mechanical systems utilizing the Operation and Maintenance Manual. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when the Project is turned over to the Owner.
C. All electrically driven or connected equipment shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC.
D. All control panels shall be provided with UL or equivalent Label and/or listing in accordance with the requirements of the NEC an applicable local codes.
1.16 EQUIPMENT/MATERIAL SUBSTITUTIONS
   A. Refer to Section 012500 Substitution Procedures for product prior approval and substitution requirements.
   B. Throughout these specifications and drawings, various materials, equipment, apparatus, etc., are specified or scheduled by manufacturer, brand name, type or catalog number. Such designation is to establish standards of desired quality and construction and shall be the basis of design and the bid.
   C. Submit proposals to supply alternative materials or equipment in writing, in accordance with Section 012500 Substitution Procedures.
   D. Equipment manufacturers listed in individual sections are approved alternatives for this project and are subject to requirements of drawings and specifications. Revisions required to adapt alternatives shall be the responsibility of the Contractor.
   E. Products furnished other than the (basis of design) shall have similar electrical characteristics as the scheduled or specified equipment. Contractor shall be responsible for any electrical changes caused by products not in accordance with this requirement.

1.17 EQUIPMENT PROTECTION AND CLEAN-UP
   A. Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts and duct systems.
   B. Protect equipment with polyethylene covers and crates.
   C. Operate, drain and flush bearings and refill with change of lubricant before final acceptance.
   D. Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Provide extended nipples for lubrication.
   E. Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.

1.18 LOCATIONS
   A. Coordination of Division 23 equipment and systems to the available space, with other trades. The access routes through the construction shall be the Contractor’s responsibility.
   B. Drawings are diagrammatic. Make offsets, transitions, and changes in direction of pipes and ducts, as required to maintain proper headroom and pitch of sloping lines and avoid structural, electrical, pipe and duct interference’s whether or not indicated on Drawings. Furnish fittings, etc., as required to make these offsets, transitions and changes in direction at no additional cost to the Owner.
   C. Determine exact route and location of ducts and coordinate and obtain approval for changes from the layout indicated on the drawings with the Owner’s Representative prior to fabrication.
   D. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Verify the physical dimensions of each item of mechanical equipment to fit the available space and promptly notify the Owner’s Representative prior to roughing-in if conflicts appear.
E. All wiring, equipment, ductwork, tubing, etc., shall be concealed within building construction unless otherwise noted, or in mechanical rooms.

F. Arrange ducts, and equipment to permit ready access to starters, motors, control components, and to clear openings of doors and access panels.

1.19 CUTTING AND PATCHING

A. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 23 shall be the responsibility of the Division 23 Contractor. All cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.

B. Patch and repair walls, floors, ceilings and roof with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner’s Representative.

C. All cutting and patching made necessary to repair defective equipment, defective workmanship or be neglect of this Contractor to properly anticipate his requirements shall be included in Division 23.

D. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative’s written approval.

E. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under this Division is responsibility of Division 23.

1.20 SCHEDULING

A. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner’s Representative. Should conditions arise where certain changes would be advisable, secure approval from Owner’s Representative for those changes before proceeding with work.

B. Coordinate with the work of various trades when installing interrelated work. Before installation of mechanical items, make proper provision to avoid interference’s. Changes required in work specified in Division 23 caused by neglect to do so shall be made at no cost to Owner.

C. Furnish and install inserts and supports required by Division 23 unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 23.

1.21 EXISTING UTILITIES

A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a Ten foot (10’) radius of the indicated location. Where connection points are not within this radius, the Contractor shall contact the Owner’s Representative for a decision before proceeding or may proceed at his own expense.

B. Connection points to existing work shall be located and verified prior to starting new work.
C. Prior to commencing any excavation or ditching activity, the Contractor shall verify the exact location and inverts of all existing utilities and connection points in the area of his proposed excavation. Notify Owner’s representative for further direction if actual inverts will not allow the proper installation of new work.

D. The Contractor shall be responsible for damages, which might be caused by his failure to exactly locate and preserve underground utilities.

1.22 PHASING AND SEQUENCE OF WORK

A. Contractor shall be aware that this is a remodel project. There will be occupied areas in the construction areas that must remain operable.

B. Work shall be bid to allow for the remodel nature of this project and the concurrent occupied areas.

C. All systems shall be fully operational to the extent that they are installed at the termination of each phase of the work.

D. System passing through existing, future, or other phase areas shall be installed, if required, to make work installed under the current phase operational.

E. All connections to and disconnection’s from existing utilities shall be coordinated with and approved by the Owner prior to proceeding with the work. Work shall be planned so as to minimize impact to areas not involved in ongoing construction. Where areas not involved in ongoing construction are to be impacted, the contractor shall identify such areas, the extent to which they will be affected and the period of time for which they will be affected. The contractor is advised that the above notification and scheduling requirement may necessitate rescheduling, partial completion and reconnection, overtime work at night or on weekends or delay of the work. Contractor costs incurred due to the above shall be included in the original bid price and shall not be the cause for additional claims or charges to the Owner.

1.23 ASBESTOS CONTROL

A. Specific attention is directed to the potential of asbestos bearing compounds and materials on the project. Careful coordination with other Contractors and reasonable care shall be exercised.

1. If other asbestos bearing or other hazardous compounds are encountered during the course of construction, the Contractor shall immediately notify the Owner who will take appropriate action to have the asbestos removed.

1.24 PROJECT FINALIZATION & STARTUP

A. Upon completion of the equipment and systems installation and connections, the Contractor shall assemble all major equipment factory representatives (Exhaust fans) and subcontractors together for system start-up and Owner instructional period.

B. These individuals shall assist in start-up and check out of their systems and shall remain at the site until the system operation is acceptable and understood to the Owner's maintenance and/or operation personnel.

C. To provide acceptance of operation and instruction by the Owner's representative, the Contractor shall prepare a written statement of acceptance explaining same for the Owner's signature.

The statement should read as follows:
"I, the Contractor, associated factory representative and subcontractor, have started each system and the total system and have proved their normal operation to the Owner's representative and have instructed him in the operation and maintenance thereof."

Owner's Representative  Contractor

D. Copies of this acceptance shall be sent to the Engineer and the Architect and one copy shall be put in each maintenance manual.

1.25 PUNCH LIST PROCEDURES

A. The Contractor shall notify the Owner’s Representative in writing when the project is ready for punch lists. After punch lists are complete, written notice must be forwarded to the Owner’s Representative requesting final checkout.

B. At the time of final observation, the project foreman shall accompany the observation party and shall remove access panels as required, to allow complete observation of the entire mechanical system.

END OF SECTION 23 00 00
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Piping materials and installation instructions common to most piping systems.
2. Dielectric fittings.
3. Sleeves.
4. Escutcheons.
5. Plumbing demolition.
6. Equipment installation requirements common to equipment sections.
7. Supports and anchorages.
8. Access doors.

1.2 DEFINITIONS

A. Finished Spaces: Spaces other than plumbing and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and plumbing equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. 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.

1.3 SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
1.5 PIPE, TUBE, AND FITTINGS
A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

1.6 JOINING MATERIALS
A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
D. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
E. Welding Filler Metals: Comply with AWS D10.12.

1.7 DIELECTRIC FITTINGS
A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
B. Insulating Material: Suitable for system fluid, pressure, and temperature.
C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1.8 SLEEVES
A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
1.9 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.
   1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
   1. Finish: Polished chrome-plated.

1.10 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors.

M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Section 07 84 13 "Penetration Firestopping" for materials.
O. Verify final equipment locations for roughing-in.

P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

1.11 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.


F. 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 ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

1.12 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
   3. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

1.13 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

1.14 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

1.15 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

1.16 ACCESS DOORS

A. Access doors to match surrounding surface, provided with recess to accept matching finish. Provide UL rated doors in fire rated construction.

B. Provide 12”x12” access doors for maintenance or adjustments purposes for all mechanical system components including valves, volume dampers, fire dampers, fire/smoke dampers, clean outs, traps and controls.

END OF SECTION 23 05 00
SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.
D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.
   2. For motors with other than 2:1 speed ratio, separate winding for each speed.


F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:
   1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
   2. Motors Smaller than 15 HP: Manufacturer’s standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

   1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
   2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
   3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
   4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

   1. Permanent-split capacitor.
   2. Split phase.
   3. Capacitor start, inductor run.
   4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.
E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13
SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Steel pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Metal framing systems.
   4. Thermal-hanger shield inserts.
   5. Fastener systems.
   6. Equipment supports.

B. See Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

C. See Division 21 Section "Wet-Pipe Sprinkler Systems" for pipe hangers for fire-protection piping.

D. See Division 23 Section(s) "Metal Ducts" or duct hangers and supports.

1.2 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel pipe hangers and supports.
   2. Thermal-hanger shield inserts.
   3. Powder-actuated fastener systems.

B. Shop Drawings: Show fabrication and installation details for the following:
1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Equipment supports.

C. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications' Article for where to use specific hanger and support types.

B. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

D. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

C. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- (690-kPa-) minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Insulation-Insert Material for Cold Piping, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
F. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS
A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 EQUIPMENT SUPPORTS
A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.7 MISCELLANEOUS MATERIALS
A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS
A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
E. Use padded hangers for piping that is subject to scratching.
F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.
8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
   a. Light (MSS Type 31): 750 lb (340 kg).
   b. Medium (MSS Type 32): 1500 lb (680 kg).
   c. Heavy (MSS Type 33): 3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.


H. Install hangers and supports to allow controlled thermal and seismic 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Install building attachments in accordance with limitations of structure as per the structural design and component limitations. Do not suspend piping, ductwork or equipment directly off of bare metal roof decking. Provide appropriate cross-bracing as necessary. Do not use eccentric beam clamps on metal bare joists, instead use concentric hangers or bolt through center section.

L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

N. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
   d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
   e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
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 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

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

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Duct labels.

1.2 SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
   1. Material and Thickness: Anodized aluminum, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   3. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
   3. Background Color: Black or blue.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
   6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.


C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.
2.4 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.


C. Background Color: Blue, Yellow or Green.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 15 feet (3.8 m) in areas of congested piping and equipment.

3.4 DUCT LABEL INSTALLATION

A. Install plastic-laminated or self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system. Do not label ducts that are exposed to view in finished spaces without ceilings.

END OF SECTION 2305 53
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:
   a. Constant-volume air systems.
   b. Variable-air-volume systems.
   c. Multizone systems.

2. HVAC equipment quantitative-performance settings.
4. Existing systems TAB.
5. Verifying that automatic control devices are functioning properly.
6. Reporting results of activities and procedures specified in this Section.

1.2 SUBMITTALS

A. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

C. Warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by AABC, NEBB or TABB.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

1.4 PROJECT CONDITIONS
A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.
B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.5 COORDINATION
A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.6 WARRANTY
A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
   1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
   2. Systems are balanced to optimum performance capabilities within design and installation limits.
B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
   1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
   2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
   1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
B. Examine approved submittal data of HVAC systems and equipment.
C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine strainers for clean screens and proper perforations.

N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

P. Examine system pumps to ensure absence of entrained air in the suction piping.

Q. Examine equipment for installation and for properly operating safety interlocks and controls.

R. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.

2. Dampers and valves are in the position indicated by the controller.

3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.
D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:
   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

   a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.

2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

3. Measure total system airflow. Adjust to within indicated airflow.

4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.

5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

   a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.

8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

   a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 PROCEDURES FOR MULTIZONE SYSTEMS

A. Set unit at full flow through the cooling coil if coil has that capacity.
B. Adjust each zone damper to indicated airflow.

3.8 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.9 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.10 PROCEDURES FOR HEAT-TRANSFER COILS

A. Water Coils: Measure the following data for each coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.
7. Air pressure drop.

B. Electric-Heating Coils: Measure the following data for each coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

C. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.11 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.12 PROCEDURES FOR COMMERCIAL KITCHEN HOODS

A. Measure, adjust, and record the airflow of each kitchen hood. For kitchen hoods designed with integral makeup air, measure and adjust the exhaust and makeup airflow. Measure airflow by duct Pitot-tube traverse. If a duct Pitot-tube traverse is not possible, provide an explanation in the report of the reason(s) why and also the reason why the method used was chosen.

1. Install welded test ports in the sides of the exhaust duct for the duct Pitot-tube traverse. Install each test port with a threaded cap that is liquid tight.

B. After balancing is complete, do the following:

1. Measure and record the static pressure at the hood exhaust-duct connection.
2. Measure and record the hood face velocity. Make measurements at multiple points across the face of the hood. Perform measurements at a maximum of 12 inches (300 mm) between points and between any point and the perimeter. Calculate the average of the measurements recorded. Verify that the hood average face velocity complies with the Contract Documents and governing codes.
3. Check the hood for capture and containment of smoke using a smoke emitting device. Observe the smoke pattern. Make adjustments to room airflow patterns to achieve optimum results.

C. Visually inspect the hood exhaust duct throughout its entire length in compliance with authorities having jurisdiction. Begin at the hood connection and end at the point it discharges outdoors. Report findings.

1. Check duct slopes as required.
2. Verify that duct access is installed as required.
3. Verify that point of termination is as required.
4. Verify that duct air velocity is within the range required.
5. Verify that duct is within a fire-rated enclosure.

D. Report deficiencies.

3.13 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate drain trap.
7. Check bearings and other lubricated parts for proper lubrication.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
4. Air balance each air outlet.

3.14 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.15 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.
4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.16 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers’ test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
3. Project name.
4. Project location.
5. Architect’s name and address.
6. Engineer’s name and address.
7. Contractor’s name and address.
9. Signature of TAB firm who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

   a. Indicated versus final performance.
   b. Notable characteristics of systems.
   c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

   a. Settings for outside-, return-, and exhaust-air dampers.
   b. Conditions of filters.
   c. Cooling coil, wet- and dry-bulb conditions.
   d. Face and bypass damper settings at coils.
   e. Fan drive settings including settings and percentage of maximum pitch diameter.
   f. Inlet vane settings for variable-air-volume systems.
   g. Settings for supply-air, static-pressure controller.
   h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

   1. Quantities of outside, supply, return, and exhaust airflows.
   2. Water and steam flow rates.
   3. Duct, outlet, and inlet sizes.
   4. Pipe and valve sizes and locations.
   5. Terminal units.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 23 05 93
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Mineral or glass fibers.
   b. Flexible elastomeric.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
7. Factory-applied jackets.
10. Tapes.
11. Securements.
12. Corner angles.

B. Related Sections:
   1. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

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

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

C. Field quality-control reports.
1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I with factory-applied vinyl jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. High-Temperature, Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type V, without factory-applied jacket.

I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide with factory-applied ASJ.

J. High-Temperature, Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type III, without factory-applied jacket.

K. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
2.2 FIRE-RATED INSULATION SYSTEMS
   A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by a NRTL acceptable to authority having jurisdiction.

2.3 INSULATING CEMENTS
   A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.4 ADHESIVES
   A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
   B. Cellular-Glass, Phenolic, Polyisocyanurate, and Polystyrene Adhesive: Solvent-based resin adhesive,
   C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.5 MASTICS
   A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
   B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
      1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
      2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
   C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
      1. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
      2. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
      3. Solids Content: 63 percent by volume and 73 percent by weight.

2.6 SEALANTS
   A. Joint Sealants:
   B. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil- (0.10-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms (0.013 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil- (0.15-mm-) thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms (0.007 metric perms) when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. Vinyl Jacket: White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. inch (4 strands by 4 strands/sq. mm), in a Leno weave, for duct, equipment, and pipe.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing

B. Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005, Temper H-14.
1. Sheet and roll stock ready for shop or field sizing.
2. Finish and thickness are indicated in field-applied jacket schedules.
3. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
4. Factory-Fabricated Fitting Covers:
   a. Same material, finish, and thickness as jacket.
   b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
   c. Tee covers.
   d. Flange and union covers.
   e. End caps.
   f. Beveled collars.
   g. Valve covers.
   h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

C. Self-Adhesive Outdoor Jacket: 60-mil- (1.5-mm-) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with stucco-embossed aluminum-foil facing.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches (75 mm).
   2. Thickness: 11.5 mils (0.29 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
   1. Width: 3 inches (75 mm).
   2. Thickness: 6.5 mils (0.16 mm).
   3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
   6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.11 SECUREMENTS

A. Aluminum Bands: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing or closed seal.

B. Insulation Pins and Hangers:
   1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
b. Spindle: Stainless steel, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.
b. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.
b. Spindle: Copper- or zinc-coated, low carbon steel, Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.
c. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, galvanized-steel, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

2.12 CORNER ANGLES

A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.
PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
5. Handholes.
6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).

2. Pipe: Install insulation continuously through floor penetrations.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket.
Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
   4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed sections of same material as straight segments of pipe insulation when available.
   2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Impale insulation over pins and attach speed washers.
   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-(150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

F. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer’s recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch-(75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant.
recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches (50 mm) over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.
4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches (850 mm) or less. The 33-1/2-inch- (850-mm-) circumference limit allows for 2-inch- (50-mm-) overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 07 Section "Penetration Firestopping."

3.9 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

2. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

3. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
5. Flexible connectors.
7. Factory-insulated access panels and doors.

3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Comply with ASHRAE 90.1 for required insulation thicknesses.

B. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

C. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.
3.13 **ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE**

A. Comply with ASHRAE 90.1 for required insulation thicknesses.

3.14 **EQUIPMENT INSULATION SCHEDULE**

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Dual-service heating and cooling pump insulation shall be the following:
   1. Mineral-Fiber Board: 2 inches (50 mm) 3-lb/cu. ft. (48-kg/cu. m) nominal density.

D. Heating-Hot-Water Pump Insulation: Mineral-Fiber Board: 2 inches (50 mm) 3-lb/cu. ft. (48-kg/cu. m) nominal density.

E. Chilled-water air-separator insulation shall be the following:
   1. Flexible Elastomeric: 1 inch (25 mm) thick.
   2. Mineral-Fiber Pipe and Tank: 1 inch (25 mm) thick.

F. Heating-Hot-Water Air-Separator Insulation: Mineral-Fiber Pipe and Tank: 2 inches (50 mm) thick.

3.15 **PIPING INSULATION SCHEDULE, GENERAL**

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.16 **INDOOR PIPING INSULATION SCHEDULE**

A. Pipe insulation thickness shall be in accordance with ASHRAE 90.1.

3.17 **OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
   1. Aluminum, Stucco Embossed: 0.020 inch (0.51 mm) thick.

END OF SECTION 23 07 00
SECTION 23 31 13
METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY
A. Section Includes:
   1. Rectangular ducts and fittings.
   2. Round ducts and fittings.
   4. Sealants and gaskets.
   5. Hangers and supports.

B. Related Sections:
   1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
   2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS
A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

   1. Static-Pressure Classes:
      a. Supply Ducts (Upstream from Air Terminal Units): 2-inch wg (500 Pa).
      b. Supply Ducts (Downstream from Air Terminal Units): 1-inch wg (250 Pa).
      e. Exhaust Ducts (Negative Pressure): 1-inch wg (250 Pa).

   2. Leakage Class:
      a. Round Supply-Air Duct: 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa).
      b. Rectangular Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg (0.29 L/s per sq. m at 250 Pa).
      c. Flexible Supply-Air Duct: 6 cfm/100 sq. ft. at 1-inch wg (0.29 L/s per sq. m at 250 Pa).

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SEI/ASCE 7.>
1.3 SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment

C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:
   a. Lighting fixtures.
   b. Air outlets and inlets.
   c. Speakers.
   d. Sprinklers.
   e. Access panels.
   f. Perimeter moldings.

D. Welding certificates.

1.4 QUALITY ASSURANCE


B. Welding Qualifications: Qualify procedures and personnel according to the following:

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M) Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:
   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   2. Tape Width: 4 inches (102 mm).
   5. Mold and mildew resistant.
   6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
   7. Service: Indoor and outdoor.
   8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
   2. Type: S.
   3. Grade: NS.
   5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
   2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.
2.6 SEISMIC-RESTRAINT DEVICES

A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

C. Restraint Cables: ASTM A 603, galvanized or ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet (3.7 m) in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches (38 mm) from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

B. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SEI/ASCE 7.

1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
2. Brace a change of direction longer than 12 feet (3.7 m).

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by the Office of Statewide Health Planning and Development for the State of California or an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.
3.7 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as follows:

   a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
   b. Concealed: Type 304, stainless-steel sheet, No. 2D finish or Carbon-steel sheet.
   c. Welded seams and joints.

2. Dishwasher Hood Exhaust Ducts:
   a. Type 304, stainless-steel sheet.
   b. Exposed to View: No. 4 finish.
   c. Concealed: No. 2D finish.
   d. Welded seams and flanged joints with watertight EPDM gaskets.


B. Intermediate Reinforcement:

2. Stainless-Steel Ducts: Galvanized steel.
3. Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."
   a. Velocity 1000 fpm (5 m/s) or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.
   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."
   c. Velocity 1500 fpm (7.6 m/s) or Higher:
      1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      3) Mitered Type RE 2 with vanes complying with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA’s "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."
a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

   1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
   2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
   3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter: Standing seam or Welded.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

   a. Rectangular Main to Rectangular Branch: 45-degree entry.
   b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

   a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
   c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 23 31 13
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
3. Control dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Flexible ducts.
9. Duct accessory hardware.

1.2 SUBMITTALS

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

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

   a. Special fittings.
   c. Control damper installations.
   d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
   e. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE


B. Comply with AMCA 500-D testing for damper rating.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.


E. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 2000 fpm (10 m/s).

C. Maximum System Pressure: 1-inch wg (0.25 kPa).

D. Frame: 0.052-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.

E. Blades: Multiple single-piece blades, center-pivoted, maximum 6-inch (150-mm) width, 0.025-inch-(0.6-mm-) thick, roll-formed aluminum, noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Extruded vinyl, mechanically locked or neoprene, mechanically locked.

H. Blade Axles:
   2. Diameter: 0.20 inch (5 mm).

I. Tie Bars and Brackets: Aluminum or galvanized steel.
J. Return Spring: Adjustable tension.

K. Bearings: Steel ball or synthetic pivot bushings.

L. Accessories:
   1. Adjustment device to permit setting for varying differential static pressure.
   2. Counterweights and spring-assist kits for vertical airflow installations.
   3. Electric actuators.
   4. Chain pulls.
   5. Front of rear screens.
   6. 90-degree stops.

M. Sleeve: Minimum 20-gage (1.0-mm) thickness.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. Standard leakage rating.
   2. Suitable for horizontal or vertical applications.
   3. Frames:
      a. Hat-shaped, galvanized or stainless-steel channels, 0.064-inch (1.62-mm) minimum thickness.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   4. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized or stainless-steel, 0.064 inch (1.62 mm) thick.
   5. Blade Axles: Galvanized steel or stainless steel.
   6. Bearings:
      a. Molded synthetic or stainless-steel sleeve.
      b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   7. Tie Bars and Brackets: Galvanized steel.

B. Damper Hardware:
   1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
   2. Include center hole to suit damper operating-rod size.
   3. Include elevated platform for insulated duct mounting.
2.4 CONTROL DAMPERS

A. Frames:
   1. Hat, U, or Angle shaped.
   2. Galvanized or stainless-steel channels, 0.064 inch (1.62 mm) thick.
   3. Mitered and welded corners.

B. Blades:
   1. Multiple blade with maximum blade width of 8 inches (200 mm).
   2. Parallel- and opposed-blade design.
   3. Galvanized or stainless steel.
   4. 0.064 inch (1.62 mm) thick.
   5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

C. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel or stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
   1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

D. Bearings:
   1. Molded synthetic or stainless-steel sleeve.
   2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   3. Thrust bearings at each end of every blade.

2.5 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.6 TURNING VANES

A. Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."
2.7 DUCT-MOUNTED ACCESS DOORS


1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Two hinges and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Three hinges and two compression latches
   d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Four hinges and two compression latches with outside and inside handles.

B. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 6-inch wg (1500 Pa).
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

2.8 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.

C. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).

E. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.
2.9 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches (146 mm) wide attached to 2 strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

   1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
   2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
   1. Minimum Weight: 24 oz./sq. yd. (810 g/sq. m).
   2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
   3. Service Temperature: Minus 50 to plus 250 deg F (Minus 45 to plus 121 deg C).

F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
   1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
   2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
   7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.10 FLEXIBLE DUCTS

A. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
   1. Pressure Rating: 10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative.
   2. Maximum Air Velocity: 4000 fpm (20 m/s).
   3. Temperature Range: Minus 10 to plus 160 deg F (Minus 23 to plus 71 deg C).
C. Flexible Duct Connectors:
   1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
   2. Non-Clamp Connectors: Liquid adhesive plus tape or adhesive plus sheet metal screws.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Downstream from manual volume dampers, control dampers, and equipment.
   3. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).

J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to low-pressure ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with draw bands.

P. Install duct test holes where required for testing and balancing purposes.

Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Centrifugal roof ventilators.

1.2 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle, square, one-piece, aluminum base with venturi inlet cone.

   1. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
D. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
4. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside or outside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Self-flashing without a cant strip, with mounting.
2. Overall Height 18 inches (450 mm).
5. Metal Liner: Galvanized steel.
6. Burglar Bars: 1/2-inch- (13-mm-) thick steel bars welded in place to form 6-inch (150-mm) squares.
7. Mounting Pedestal: Galvanized steel with removable access panel.
8. Vented Curb: Unlined with louvered vents in vertical sides.

2.2 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and elastomeric hangers or spring hangers having a static deflection of 1 inch (25 mm).
E. Install units with clearances for service and maintenance.

F. Label units according to requirements.

G. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

H. Install ducts adjacent to power ventilators to allow service and maintenance.

I. Ground equipment.

J. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 34 23
SECTION 23 37 13
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS
   A. Product Data: For each product indicated, include the following:
      1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 GRILLES AND REGISTERS
   A. Adjustable Bar Grille:
      1. Material: Steel, Aluminum or Stainless steel.
      2. Finish: Baked enamel, white.
      3. Face Blade Arrangement: Adjustable vertical spaced 3/4 inch (19 mm) or 1/2 inch (13 mm) apart.
      4. Rear Blade Arrangement: Adjustable horizontal spaced 3/4 inch (19 mm) or 1/2 inch (13 mm) apart.
      5. Frame: 1 inch (25 mm) wide.
      6. Mounting: Surface or Lay-in.
   B. Fixed Face Grille:
      1. Material: Steel or Aluminum.
      2. Finish: Baked enamel, white.
      4. Frame: 1 inch (25 mm) wide.
      5. Mounting: Surface or Lay-in.

2.2 CEILING DIFFUSER OUTLETS
   A. Round Ceiling Diffuser:
      1. Material: Steel or Aluminum.
      2. Finish: Baked enamel, white.
      3. Face Style: Multi-cone.
4. Pattern: Two position horizontal.
5. Dampers: Radial opposed blade or butterfly.

B. Rectangular and Square Ceiling Diffusers:

1. Material: Steel or Aluminum.
2. Finish: Baked enamel, white.
3. Face Size: 24 by 24 inches (600 by 600 mm) for Lay-in Applications.
4. Face Style: Four core adjustable.
5. Mounting: Surface or Lay-in.

C. Louver Face Diffuser:

1. Material: Steel or Aluminum.
2. Finish: Baked enamel, white.
3. Face Size: 24”x24” for Lay-in applications.
4. Mounting: Surface with beveled frame or Lay-in.
5. Pattern: Four-way core style.

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713
SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Division 07, Penetration Firestopping.

1.2 SUMMARY

A. This performance specification section provides the minimum requirements for a complete and operational electrical system for an AAFES BX or PX (Base Exchange, Post Exchange OR Fort Exchange) Retail Store and Mall. The electrical and low-voltage systems shall include but are not limited to all design, equipment, materials, labor, installation, documentation, testing and services necessary to furnish and install a complete, operational AAFES Retail Store and Mall to include but are not limited to the following functions:

1. Retail Store
2. Store Administration Area
3. MPA Area and MPA Mezzanine Space
4. Food Court
5. AAFES food and other vendors, equipment and all connections to same
6. Military Clothing Store (MCSS)
7. Separate Security Rooms
8. Communications IT Rooms and Hubs and horizontal data cabling not exceeding 90 meters and incoming building service cabling and fiber optic for both public and government services.
9. Electrical Rooms and Equipment Rooms for panels, sub-distribution and fire alarm/mass notification
10. Lighting and Control System to meet current AAFES, UFC, Energy Codes and LEED Requirements and state and local codes.
11. Fire Alarm/Mass Notification System to meet UFC Standards
12. Security Intrusion System – To meet current Base, Fort or Camp Standards.
13. Public Address System
14. Primary medium voltage cabling, underground duct bank, and padmounted oil-filled transformers for new electrical services to building
15. Fire pump
16. Fuel-efficient vehicles parking with limited number of electrical connections for electric cars.
17. Automated access gates to employee parking and remote operation

B. Section Includes:

1. Electrical equipment coordination and installation
2. Grout, concrete
3. Access doors and frames
4. Common electrical installation requirements
5. Fire stopping
6. Cleanup/Touchup paint
7. Safety conditions
8. AF/AI material and equipment
9. AAFES furnished, Contractor installed equipment
1.3 CONTRACT DOCUMENTS

A. All electrical and limited energy systems, mounting hardware, labor and other items indicated on the Division 26, 27 and 28 drawings, schedules and/or in the specifications shall be included in the Contractor’s bid, unless specifically indicated otherwise. The specifications, schedules, diagrams, details and plans are complementary and what is indicated on any is as binding as if indicated on all. Where a conflict exists between what is shown and what is specified, the more stringent shall govern.

B. The contract drawings indicate the extent and the general character and approximate location and arrangement of material and equipment. The documents do not necessarily show the total number of conductors, raceways, boxes, support, access panels, actual routing, block outs, exact device or equipment locations or other such detailed information for the work required. The Contractor shall provide all necessary materials as required by applicable code and product specification for a complete and fully operational installation in accordance with the true intent of the drawings and specifications.

C. All dimensions indicated in the Division 26, 27 and 28 drawings are approximate and are indicated as a guideline only. The Contractor shall adjust the exact rough-in locations as necessary to avoid conflict with structural components or other materials and to assure that fixtures, boxes, etc., can be installed as close to the intended location as possible. Working measurements shall be taken from the building and checked with the Architectural and Structural drawings. If conflicts are found the Contractor shall request verification from the Architect before proceeding with that work.

D. The Division 26, 27 and 28 documents do not separate work or responsibilities of sub-contractors. The General Contractor is responsible for defining the scope of work of each contractor. This specification recognizes only one contractor. That is the General Contractor who signs the contract with the Owner. Where the term ‘The Contractor’ is used, it applies to the contractor responsible for the installation of the work described.

1.4 ELECTRICAL REFERENCE SYMBOLS & DEFINITIONS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ADA</td>
<td>Americans With Disabilities Act</td>
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<tr>
<td>AFC</td>
<td>Above Finished Ceiling</td>
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<tr>
<td>AF/AI</td>
<td>AAFES Furnished and AAFES Installed</td>
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<tr>
<td>AF/CI</td>
<td>AAFES Furnished and Contractor Installed</td>
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<tr>
<td>AFF</td>
<td>Above Finished Floor</td>
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<tr>
<td>Ampacity</td>
<td>Capacity expressed in amperes</td>
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<tr>
<td>ASTM</td>
<td>American Society for Testing &amp; Materials</td>
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<tr>
<td>CF/CI</td>
<td>Contractor-Furnished and Contractor-Installed</td>
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<tr>
<td>Concealed</td>
<td>Hidden from sight as in trench, chases, slabs, furred spaces or hung ceilings</td>
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<tr>
<td>Contractor</td>
<td>Shall mean the General Contractor who signs the contract with the Owner</td>
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<td>EMT</td>
<td>Electrical Metallic Tubing</td>
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<td>EPDM:</td>
<td>Ethylene-propylene-diene terpolymer rubber.</td>
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<td>Exposed ‘</td>
<td>Not concealed’ as defined above</td>
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<td>Furnish</td>
<td>Supply</td>
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<td>Galv.</td>
<td>Galvanized</td>
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<td>GFICI</td>
<td>Ground Fault Circuit Interupter</td>
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<td>IBC</td>
<td>International Building Code</td>
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<td>IEC</td>
<td>International Energy Code</td>
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<td>IFC</td>
<td>International Fire Code</td>
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<td>Institute of Electrical &amp; Electronic Engineers</td>
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<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
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<td>Indicated on drawings</td>
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<td>Mfg.</td>
<td>Manufacturer</td>
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<tr>
<td>NBFU</td>
<td>National Board of Fire Underwriters Pub. 70 (latest edition)</td>
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</table>
1.5 SUBMITTALS

A. It is understood that before the manufacture or installation of any of the work under this contract is carried forward, shop drawings of such work shall be submitted for review. Shop drawings shall be submitted in ample time to avoid delay in any of the work. The Contractor shall allow for 30 days minimum for completion of review and processing. Items requiring prompt attention due to long lead delivery or for early construction rough-in, are to be identified. The review of these items will be expedited, with advanced copies returned.

B. The Architect and Engineer’s review of the submittals/shop drawings is intended as a check for general conformance with contract documents only. Failure by the Architect or Engineer to discover an error on a submittal does not relieve the Contractor of the responsibility for compliance with requirements of the drawings and specifications.

C. The Division 26 Contractor shall provide quantities of submittals and shop drawings as required by Section 01300 for distribution. In addition, two paper copies of each brochure or shop drawing (up to 11"x17" size) shall be inserted in a common binder, index referenced and equipped with tabbed partitions. Larger size shop drawings shall be submitted separately to the Electrical Engineer.

D. Upon request from the Architect or Engineer, provide material samples for examination, color selection and/or quality control. These samples shall be delivered to the Architect’s or Engineer’s office as directed.

E. Prior to forwarding to the Architect, the Contractor shall review the submittals; mark them with their comments, corrections and approval stamp. The Contractor shall verify that all of the specified requirements are indicated and ensure that the intended items have been identified on the submittal. Submittals shall be clearly marked as to which items, options, colors; models, etc. are being provided. Only the items marked or indicated will be considered as being submitted. If no marks or indications are present on a page then it will be assumed that nothing applies to this project and the submittal will be rejected. Indicate additional information necessary for the Architect and Engineer to determine the Contractor’s intention, such as the method of feeding panel boards (top or bottom), color selection, equipment options, etc.

F. For material requiring color or finish selection ‘by Architect’, provide separate copies marked ATTENTION (ARCHITECTS NAME) – COLOR/FINISH SELECTION REQUIRED’.

G. Provide brochures and shop drawings on the following materials:

Interior dimensioned plan view and elevations of electrical rooms showing main component arrangement with NEC required working clearances shown

Panelboards

Wiring Devices
Extra receptacle log with fair cost estimate
Keyed Switches
Floor Boxes  Wiring (feeders, branch circuits, etc)
Lighting Fixtures, Lamps, Ballast
Occupancy Sensors
Security System (Intrusion Detection)

Conduit and Fittings

Security System

Premise Wiring:
Certification of Contractor

Wire Management
Identification

1.6  COORDINATION

A.  Coordinate arrangement, mounting, and support of electrical equipment:

1.  To allow maximum possible headroom unless specific mounting heights that reduce head-
room are indicated.

2.  To provide for ease of disconnecting the equipment with minimum interference to other in-
stallations.

3.  To allow right of way for piping and conduit installed at required slope.

4.  So connecting raceways, cables, wire-ways, cable trays, and bus-ways will be clear of ob-
structions and of the working and access space of other equipment.

5.  To maintain access and keep passageways clear.

B.  Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, ma-
sonry walls, and other structural components as they are constructed.

C.  Coordinate location of access panels and doors for electrical items that are behind finished surfaces 
or otherwise concealed

D.  Coordinate sleeve selection and application with selection and application of fire-stopping specified 
in Division 07 Section ‘Penetration Firestopping’.

E.  Coordinate all rough-in and circuit routing with other division manufacturer’s shop drawings and 
submittals for casework and equipment, which requires power or systems connections. Verify the 
exact locations of all electrical rough-in, devices, equipment or apparatus to be pre-determined work 
required and to ensure that Division 26, 27 and 28 equipment will fit and function as intended before 
proceeding with rough-in or installation. Carefully lay out all devices and equipment so that they are 
not blocked, hidden or rendered inaccessible due to conflict with structure, casework, ductwork, pip-
ing, etc.

F.  The Contractor shall coordinate all device locations with the architectural documents. Check all door 
wings (locate switches on strike side of door), window casings, counter back splash, sinks and 
casework knee spaces and on countertops so that electrical outlets and equipment are accessible and 
in proper relation to these items.
G. The Contractor shall coordinate and verify the exact location and requirements for connections to equipment furnished under other divisions which require electrical systems connections provided under Division 26, 27 and 28. Verify the location of ductwork, grilles, plumbing, access panels, control devices and other equipment requiring electrical installation.

H. The Contractor shall coordinate exact location and requirements for connections to equipment furnished by the Owner. Where equipment is existing to be relocated, field verify circuiting and connection requirements prior to rough-in. Where equipment is being purchased new, verify connections with the Owner’s representative.

I. Verify that the wall depth is adequate to allow flush mounting of all panels or enclosures in the intended location prior to installing underground feeders.

J. Verify that all switchgear, panelboards, transformers, enclosures, backboards and other Division 26 provided equipment are located and installed to meet NEC working clearance requirements.

K. The Contractor will not receive extra compensation for cutting, patching, re-finishing or re-wiring required for relocation of work installed due to interference between the various work that could have been avoided, had proper coordination been applied.

L. Schedule and coordinate all power, telephone and CATV utility work to provide the required ‘customer furnished’ material and labor (included in Division 26, 27 and 28 bid), to the requirements of the appropriate utility company.

1.7 CODES AND CRITERIA

A. Systems will be designed to comply with the following:

1. International Building Code as modified by UFC 1-200-01
3. International Fire Alarm Code
5. ASHRAE Standard 90.1, 2010 Energy Standards for Buildings
6. Americans with Disability Act (ADA)
7. ANSI/TIA 942 – Telecom Infrastructure Standard for Data Centers
8. UFC 3-400-01 Energy Conservation
9. UFC 3-501-03N Electrical Engineering Preliminary Considerations
10. UFC 3-520-01 Interior Electrical Systems
11. UFC 3-530-01 Interior and Exterior Lighting and Controls
12. UFC 3-55-03 FA Electrical Power Supply and Distribution
13. UFC 3-550-03N Power Distribution Systems
14. UFC 3-560-01 Electrical Safety, O&M; with Change 2
15. UFC 3-580-01 Telecommunications Building Cabling Systems Planning and Design
16. UFC 3-600-01 Fire Protection Engineering for Facilities
17. UFC 3-600-02 O&M: Inspection, Testing, and Maintenance of Fire Protection System
18. UFC 4-010-01 DoD Minimum Antiterrorism Standard for Buildings
19. DoD 5200.1-R DoD Information Security Program
20. DCID 6/9 Physical Security for Sensitive Compartmented Information Facilities
22. Real Estate Standards
23. Local Base, Fort or Camp Installation Design Guidelines
25. High Performance Sustainable Building (HPSB)
27. 10 CFR 435 Energy Performance Standards (Jan 93)
28. 10 CFR 436 Federal Energy Management and Planning Programs
29. 10 CFR 450 Energy Measures and Energy Audits
30. 24 CFR 39 Cost Effective Energy Conservation and Effectiveness Standards

B. The installation of this work shall comply in every way with the requirements of the laws, ordinances and rules of the State, the National Board of Fire Underwriters and the National Electric Code.

C. If any conflict occurs between these rules and this specification, the rules shall govern. Nothing in these drawings and specifications shall be construed to permit work not conforming with governing codes. This shall not be construed as relieving the Contractor from complying with any requirements of the plans or specifications which may be in excess of requirements of hereinbefore mentions rules and not contrary to same.

D. Obtain and pay for all licenses, permits, registration fees and inspections required by laws, ordinances and rules governing the work specified herein. Arrange for inspection of the work by inspectors and give the inspectors all necessary assistance in their work of inspection.

PART 2 PRODUCTS

2.1 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.2 ACCESS DOORS AND FRAMES

A. Access panels shall be the responsibility of each related section of Division 26. All access doors on the project are to be the product of one manufacturer. Closely coordinate the type of access doors and locations with all other Divisions.

B. Where required for access to hidden junction boxes or other Division 26 equipment, the doors shall be sized as necessary to provide proper working clearance. Provide access door at all roll-up gate motors above gypboard ceilings.

C. Provide identification tags for all Division 26 access doors.

PART 3 EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

F. All material and equipment shall be installed symmetrical, level, plumb, parallel and perpendicular to other building systems and components, except where otherwise indicated.

G. Use ‘watertight’ compound for all watertight seals to outside or freezer/coolers.

3.2 UTILITIES

A. Power:

B. Telephone:

3.3 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section ‘Penetration Firestoping’.

3.4 CLEANUP

A. Removal of refuse, debris, cuttings, packaging, cartons, etc. for work provided under Division 26 shall be the responsibility of each related section of Division 26.

B. Cleanup shall be done continually during construction, at sufficient frequency to eliminate hazard to the public, occupants, workmen, the premise and adjacent property.

C. Before acceptance of the installation, carefully clean cabinets, panels, boxes, wiring devices, cover plates, etc., to remove dirt, cuttings, paint, plaster, mortar, concrete, etc. Blemishes to finished surfaces of apparatus shall be removed and new finish equal to the original applied.

3.5 TOUCHUP PAINTING

A. Touch up or repair of factory finishes that are scratched or marred in shipment or installation shall be the responsibility of each related section of Division 26.

B. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.

C. Follow paint manufacturer’s written instructions for surface preparation and for timing and application of successive coats.

D. Repairs shall be made to the satisfaction of the Government and Contracting Officer.

3.6 SAFETY CONDITIONS

A. The Contractor will be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. The duty of the Contracting Officer to conduct construction observations of the Contractor's performance is not intended to include review of the adequacy of the Contractor's performance measures, in, on, or near the construction site.
B. Furnish, erect and maintain all barricades, guard structures, warning signs, detour signs, lights and flares as may be required to protect and safeguard from injury or damage.

C. Provide bracing, scaffolding, guard rails and protective devices necessary to protect workmen and personnel from personal injury due to electrical installations while on the jobsite.

D. Contractor shall be liable for all damage and injury occurring to the Government’s property on or in the adjacent areas of the work, or which shall occur to any person or property whatsoever by reason of the negligence of the Contractor or any of his employees, or sub-Contractors, or of any breach or violation of the provisions of this agreement, or of any of his duties or obligations under the contract.

E. Temporary power used for construction shall be ground fault protected.

3.7 ELECTRICAL PHASEING REQUIREMENTS

A. Construction phasing unless specifically indicated in the architectural drawings or specifications is the responsibility of the General Contractor.

B. Parking lot lighting in the existing BX Building shall remain in operation throughout the project. At no time shall the existing parking lot be without lights.

C. The existing store and mall shall not be without electrical power or communications while construction work is being done in the new store and mall during normal operation hours. All power interruptions shall be after store hours and be scheduled and approved with the base and AAFES 30 days prior to any interruptions and again seven (7) days and one (1) hour prior to any pre-scheduled outage.

3.8 AAFES FURNISHED AND INSTALLED EQUIPMENT

A. Certain items of equipment will be furnished and installed by AAFES. See drawings references to (AF/AI).

1. See Division 10.

B. The Contractor shall provide for a cooperative with personnel installing AAFES furnished materials and equipment, should overlap of work occur.

3.9 TYPICAL MATERIALS AND EQUIPMENT (AF/AI)

A. Equipment or material to be furnished and installed by AAFES but not limited to, is as follows and as indicated on the drawings:

1. All store shelving and fixtures in Mall and Retail
2. Check-out fixtures in Mall and Retail
3. Close circuit (CCTV) video security system equipment and wiring
4. Graphic signage (painted) at Main Entry and at Check-out in Retail
5. Microwaves, refrigerators, washer and dryer
6. Work stations in Customer Service
7. Bailer in MPA
8. Floor mats in Beauty and Barber Shops
9. Safes, printers, meat slicer, cash registers, small wares packages in Food Court
10. ATM Machines
11. Shelving, fixtures, work/service counters and equipment in Optical Shop and Clinic, Florist, Concessions and MCSS.
12. Coffee cart in Food Court
13. Kiosks and benches in Mall and Retail
14. Office furniture
15. Dry storage shelving
16. ELCC Communications and Center Equipment (as indicated)
17. Slotwall
18. EAS Merchandise Detectors
19. Signage
20. CATV cabling, outlets and fittings
21. Data and Telephone CAT 6 Cabling Per 271500

3.10 FINAL CONNECTIONS

A. All final electrical connections to AAFES furnished and installed equipment shall be made by the Electrical Contractor as part of the construction contract. The electrical contractor shall provide all conduit, wire, J-boxes, and miscellaneous equipment necessary and make the equipment operational.

B. The Contractor shall adjust all wire sizes and breakers, and disconnect sizes, at no extra cost to the Owner. This cost shall be included in the Bid for connection to all AAFES provided equipment.

3.11 AAFES FURNISHED, CONTRACTOR INSTALLED EQUIPMENT

A. The material noted below will be furnished by the Exchange and shall be installed and made operational by the Contractor. See drawing references to (AF/CI). The Contractor shall provide for and cooperate with personnel furnishing the designated material.

B. Provide all conduit and wire to equipment. Electrical Contractor shall field verify nameplate rating prior to pulling in wire and purchasing and installation of disconnects, breakers, etc. after all equipment is on site and ready for installation.

C. Provide cost in bid to adjust all breakers, conduits, wire size, disconnect sizes either direction larger or smaller to equipment after equipment is on site.

3.12 DELIVERY

A. Contractor shall unload, handle, store, protect, uncrate, assemble, set in final position, align, join, and level all Exchange-furnished material, and shall make all utility connections thereto. AAFES will provide supervision for installation of the material. Electrical Contractor shall field verify nameplate ratings of the equipment prior to pulling in wire and making final connections. Contractor shall adjust wire sizes and breaker disconnect sizes (either direction larger or smaller) at no extra cost to the Owner. This cost shall be included in Bid.

3.13 MATERIALS AND EQUIPMENT (AF/CI)

A. Contractor shall install and make connections but not limited to the following AAFES furnished items at locations indicated on drawings:

1. Dressing rooms
2. Sales Area cornice (gondolas) fixtures with Contractor provided lamps
3. Electronics’ Sales Signage and 3 Gang Outlets at Each Retail Fixture.

B. Execution
1. Equipment Branch Circuits: Provide different breakers to make connections to AAFES equipment with different amp rating. Install in finished walls and ceilings. Include cost in bid. Allow $1,000.00

END OF SECTION 260500
SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY
A. This section includes the following:
   1. Copper Conductors – 600 Volt and Less

1.2 DEFINITIONS
A. EPDM: Ethylene-propylene-diene terpolymer rubber.
B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Comply with NFPA 70 and UL.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER’S
A. Manufacturers of wires and cables, subject to requirements of the specifications are Okanite, Pirelli, American Insulated Wire Co., Anaconda-Ericson Inc.; Wire and Cable Division, Belden Division, Cooper Industries, General Cable Corp., Rome Cable Corp., or accepted equal.
B. General: Provide electrical wires and cables of manufacturer’s standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F).
C. All wire shall be rated for the area or method it is to be installed; ie., air plenum, cable tray, direct bury, etc.

2.2 BUILDING WIRE (600V)
A. A complete system of copper conductors shall be installed in the conduit systems. Wire and cable shall be brought to the job in original containers bearing the Underwriters Label. Wire shall be color coded per NEC and marked with gauge, type, and make. All feeders and wiring larger than #2 AWG shall be type THHH or XHHW rated 75 degrees C only. #2 AWG and smaller wire to be type THHN/THWN.
B. In arctic conditions use only XHHW conductor insulation outside of building, underground or below slab.
C. Minimum wire sizes to be as follows:
   Lighting and power branch circuits #12 AWG Min Stranded
D. All service conductors shall be stranded. Wires and cables #6 and smaller shall be factory color coded. Wires shall be color coded as follows:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Maximum 250 V Phase to Phase</th>
<th>Maximum 600V Phase to Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td>Black</td>
<td>Brown</td>
</tr>
<tr>
<td>Phase B</td>
<td>Red*</td>
<td>Orange</td>
</tr>
<tr>
<td>Phase C</td>
<td>Blue</td>
<td>Yellow</td>
</tr>
<tr>
<td>Neutral</td>
<td>White</td>
<td>Gray</td>
</tr>
<tr>
<td>Ground</td>
<td>Green</td>
<td>Green</td>
</tr>
</tbody>
</table>

- Use orange for a three phase, four wire delta system.

E. All line voltage circuit conduits shall be provided with a grounding conductor.

2.3 ALUMINUM SUBSTITUTION

A. None Allowed.

PART 3 EXECUTION

3.1 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal all cables in Raceways finished walls, ceilings, and floors.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer’s recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. No more than four branch circuits in any home run. No more than one branch circuit per neutral conductor. When more than three current carrying conductors are installed in a single raceway, wire and/or conduit size shall be increased to comply with Article 310-17 and 310.15(B)(3)(a) of the NEC.

E. Each branch circuit phase conductor serving isolated ground type receptacles shall be run with a dedicated neutral and dedicated ground wire.

F. For isolated ground circuits provide isolated ground bus and all required switchgear/panelboard modifications to accommodate the additional neutral grounding conductors.

G. All plastic bushings or other such items shall be installed prior to wire pulling.

H. Where phase tape is required to identify the conductor phase it shall be located at the termination point.

I. Where motor rotation dictates that two conductors be swapped, such swap shall occur at the motor end not the panelboard end or on the load side of any disconnecting device servicing said motor.
J. Each branch circuit phase conductor serving lighting circuits with electronic dimmers shall be provided with a dedicated neutral conductor and such neutral conductors shall not be intermixed.

K. Neatly train wire inside boxes, equipment, contactors, panelboard and other such electrical equipment. Do not bundle conductors with tie-wraps, etc.

L. Conductor length for parallel feeders shall be identical.

M. Conductors shall be suitably protected against painting or other substances throughout the entire installation process. It shall be the Division 26 Contractors’ responsibility to assure that the insulation is in no way susceptible to substances such as paint or plaster. All device openings shall be protected with masking tape or similar protection and this protection maintained until device installation time.

N. Prior to final installation, all conductors shall be pigtail connected. Pigtails to device shall be limited to the minimum number of conductors required to place the device into service.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unsPLICed conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150mm). All outlets shall be connected by 6 inch (150mm) pigtails from the outlet to the branch circuit wiring.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors.

C. Remove and replace any defective wire or cable.

END OF SECTION 26 05 19
SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

1.2 DEFINITIONS

A. EMT: Electrical metallic tubing.
B. IMC: Intermediate metal conduit.
C. RMC: Rigid metal conduit.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force, or as required by Authorities Having Jurisdiction.

1.4 SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.
   2. Nonmetallic slotted support systems.
B. Shop Drawings: Signed and sealed by a qualified structural professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.
   2. Steel slotted channel systems. Include Product Data for components.
   3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.5 QUALITY ASSURANCE

A. Comply with NFPA 70.

PART 2 PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

B. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

2. Nonmetallic Coatings: Manufacturer’s standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

3. Painted Coatings: Manufacturer’s standard painted coating applied according to MFMA-4.

4. Channel Dimensions: Selected for applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

2. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

5. Toggle Bolts: All-steel springhead type.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

2.2.1.1 Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

2.2.1.1.2 Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 EXECUTION

3.1 APPLICATION

3.1.1 Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

3.1.2 Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

3.1.3 Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

3.1.3.1 Secure raceways and cables to these supports with two-bolt conduit clamps, single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

3.1.3.2 Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

3.2.1 Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

3.2.2 Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

3.2.3 Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

3.2.4 Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

3.2.4.1 To Wood: Fasten with lag screws or through bolts.

3.2.4.2 To New Concrete: Bolt to concrete inserts.

3.2.4.3 To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

3.2.4.4 To Existing Concrete: Expansion anchor fasteners.
3.2.4.5 To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.

3.2.4.6 To Light Steel: Sheet metal screws.

3.2.4.7 Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

3.2.4.8 Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

3.3.1 Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

3.3.2 Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

3.4 PAINTING

3.4.1 Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

3.4.1.1 Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

3.4.2 Touchup: Comply with requirements in Division 09 painting section for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

3.4.3 Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29
PART 1 - GENERAL

1.1 SUMMARY
This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS
EMT: Electrical metallic tubing.
ENT: Electrical nonmetallic tubing.
EPDM: Ethylene-propylene-diene terpolymer rubber.
FMC: Flexible metal conduit.
IMC: Intermediate metal conduit.
LFMC: Liquidtight flexible metal conduit.
LFNC: Liquidtight flexible nonmetallic conduit.
NBR: Acrylonitrile-butadiene rubber.
RNC: Rigid nonmetallic conduit.

1.3 SUBMITTALS
Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Qualification Data: For professional engineer and testing agency.

Source quality-control test reports.

1.4 QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

Rigid Steel Conduit: ANSI C80.1; UL 6
1. Rigid threaded zinc-coated steel conduit.

IMC: ANSI C80.6; UL 1242
2. Intermediate Metal Conduit (IMC)

PVC-Coated Steel Conduit: PVC-coated rigid steel conduit or IMC.
3. Comply with NEMA RN 1.
4. Coating Thickness: 0.040 inch (1 mm), minimum.

EMT: ANSI C80.3.

LFMC: Flexible steel conduit with PVC jacket.

Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

5. Fittings for EMT: Steel or die-cast, compression type. [Use steel for south NAVFENGCOM projects].

6. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

LFNC: UL 1660

Fittings for RNC: NEMA TC3, match to conduit type and material.

Fittings for LFNC: UL 514B.

ENT: Not Allowed

2.3 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

Description: Comply with UL 2024; flexible type, approved for plenum, riser, or general-use installations. Carlon orange.

Description: Comply with UL 2024 Flex 166 type, approved for plenum on general use installations. Maxcell inner duct styles 3 inch, 3 cell.

2.4 METAL WIREWAYS

Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated.

Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

Wireway Covers: Hinged type, screw-cover type, or flanged-and-gasketed type, rated for location installed.

Finish: Manufacturer's standard enamel finish.

2.5 SERVICE POLES

Surface Metal Raceways: UL5 two-piece, painted, totally enclosed galvanized steel or aluminum with Snap-On covers. Manufacturer’s custom enamel finish in Wilson Art frosty white 15-73-60 color or as selected by AAFES. Poles to be Hubbell #HBLPP15-Frosty White or equal.

1. A full compliment of fittings shall be provided as required for a complete raceway system, including but not limited to, flat, internal and external elbows, tees, entrance fittings, cover clips, wire clips, support clips and end caps. The fittings shall match the base and cover. All fittings shall be supplied with a base where applicable. Transition fittings shall be available to adapt to an existing flush wall box.

2. Device fittings with faceplate and ID labels shall be available to mount stand and devices and device faceplates in single gang configurations.
2.6 BOXES, ENCLOSURES, AND CABINETS

Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

Nonmetallic Outlet and Device Boxes: NEMA OS 2.

Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

Nonmetallic Floor Boxes: Nonadjustable, round.

Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum or galvanized, cast iron with gasketed cover.

Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

Cabinets:

2. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

3. Hinged door in front cover with flush latch and concealed hinge.

4. Key latch to match panelboards.

5. Metal barriers to separate wiring of different systems and voltage.

6. Accessory feet where required for freestanding equipment.

2.7 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Stainless steel. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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

1. Advance Products & Systems, Inc.
2. Cal Pico, Inc.
3. Metraflex Co.
4. Pipeline Seals and Insulator, Inc.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.

2. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations or as otherwise indicated:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

5. Damp or Wet Locations: Rigid steel conduit, IMC or EMT, with weathertight fittings.

6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical fiber/communications cable raceway in EMT.

7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: Riser-type, optical fiber/communications cable raceway in EMT.

8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General-use, optical fiber/communications cable raceway, plenum-type, optical fiber/communications cable raceway in EMT.

9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.

Minimum Raceway Sizes Electrical Power/Lighting: 1/2-inch (16-mm) trade size. Communications: 1 inch (27mm) trade size. Fire/Mass Notification Systems: ¾ inch (19mm) trade size.
Raceway Fittings: Compatible with raceways and suitable for use and location.

10. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

11. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

Complete raceway installation before starting conductor installation.

Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

Arrange stub-ups so curved portions of bends are not visible above the finished slab.

Install no more than the equivalent of four 90-degree bends in any conduit run except for communications conduits, for which only two bends are allowed.

Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

Install pull cords in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Identify each end to indicate destination.

Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

Install pull cords in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Identify each end to indicate destination.

RACEWAYS FOR OPTICAL FIBER AND COMMUNICATIONS CABLE:

1. 1-Inch (27-mm) Trade Size: Install raceways in maximum lengths of feet.

2. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with 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:

3. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

4. Where otherwise required by NFPA 70.

Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F (17 deg C), and that has straight-run length that exceeds 25 feet (7.6 m).
5. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

   a. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

6. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.

7. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

8. Use LFMC in damp or wet locations subject to severe physical damage.
9. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

Recessed Boxes on Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Set metal floor boxes level and flush with finished floor surface.

Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

1.1

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section ‘Penetration Firestopping’. Electrical penetrations occur when raceways cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floors and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side greater than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches (1270 mm) and 1 or more sides equal to, or greater than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm)

Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

Cut sleeves to length for mounting flush with both surfaces of walls.
Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

Size pipe sleeves to provide ¼ inch (6.4 mm) annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section ‘Joint Sealants’ for materials and installation.

Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section ‘Penetration Firestopping’.

Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25 mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

Underground, Exterior-Wall Penetrations: Install cast-iron ‘wall pipes’ for sleeves. Size sleeves to allow for 1-inch (25 mm) annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assembly mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section ‘Penetration Firestopping’.

3.6 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33
SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY
   A. Section Includes:
      1. Distribution panelboards.
      2. Lighting and appliance branch-circuit panelboards.
      3. Load centers.
      4. Electronic-grade panelboards.
   B. Provide 25% spare ampacity in all panelboards above final loads and 30% extra breaker space with bussing and all hardware for future breakers. Provide 10% spare breakers in each panel in addition to the 30% extra breaker space. Don’t provide panels smaller than 100 amps for vendors and AAFES areas. Each vendor shall have their own electrical panel servicing only their stores or area. Provide main breakers in all panels per UFC.

1.2 REFERENCES
   A. NECA Standard of Installation (published by the National Electric Contractors Association).
   B. NEMA AB1 – Molded Case Circuit Breakers.
   C. NEMA ICS 2 – Industrial Control Devices, Controllers and Assemblies.
   D. NEMA KS1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
   E. NEMA PB 1 – Panelboards.
   F. NEMA PB 1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less.
   H. NFPA 70 – National Electric Code

1.4 DEFINITIONS
   A. SVR: Suppressed voltage rating.
   B. TVSS: Transient voltage surge suppressor.
1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term ‘withstand’ means ‘the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

1.6 SUBMITTALS

A. Product Data: Overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Include evidence of NRTL listing for series rating of installed devices.

3. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

4. Include wiring diagrams for power, signal, and control wiring.

5. It shall be the contractor’s, supplier’s and manufacturer’s responsibility to ensure that the equipment purchased for installation will fit in the space available and to insure compliance with all applicable code required working clearances.

6. Should it be determined that the space available is not sufficient for the manufacturer’s equipment, the contractor shall develop a plan which is acceptable to AAFES and the Government for placing the equipment in a satisfactory layout which meets all required working clearances.

7. No equipment shall be purchased without verification that the space available is adequate for the intended manufacturer’s equipment.

C. Seismic Qualification Certificates: Submit certification that overcurrent protective devices, accessories, and components will withstand seismic forces. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Contractor’s Review: Prior to submitting the required material for review the contractor shall review all documentation received from the manufacturer and make notations to correct non-compliant items. Prior to forwarding the reviewed documentation for review, the contractor shall stamp the documents as
‘Accepted’ or ‘Accepted as Noted’. Submittals which have not been pre-reviewed by the contractor or marked as previously stated shall be rejected.

E. Panelboard Directories: Installed on the inside of the doorframe under the plastic cover and slot provided. The directory shall be typewritten with spares and spaces written in pencil. The Contractor shall identify the type of load and area served by each circuit using the permanent (end use) room numbers as determined by the Owner. Include all field changes and change order additions and deletions to the schedule. Attached copies of the panel schedules are not acceptable substitution. Provide new updated directories for all existing panelboards with load revisions.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. Include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency’s Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:

1. General Electric
2. Siemens
3. Square D
4. Cutler Hammer

2.06 DISCONNECTING AND OVERCURRENT PROTECTIVE

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.


3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip
   b. Long- and short-time pickup levels
   c. Long- and short-time time adjustments
   d. Ground-fault pickup level, time delay and \( I^2t \) response

2. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

3. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).


6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application, Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
   f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
g. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.07 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

2.08 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject Panelboards that are damaged or rested or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

E. The panelboards must fit in the allotted space shown on the drawings and meet all NEC required working clearances.

F. Acceptance of the manufacturers listed above is conditional upon compliance with the electrical and spatial requirements of the project.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

C. Install filler plates in unused spaces.

D. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

E. Comply with NECA 1.
3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs in compliance with Fort standards and direction of AAFES.

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate in compliance with Fort standards and direction of AAFES.

D. NEC, State and local code required flash protection labels.

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Perform tests, inspections and make adjustments per the manufacturer's instructions and as specified.

2. Manufacturer's Field Service: Engage a factory-authorized service representative for technical support and to assist in testing.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Panelboards will be considered defective if they do not pass tests and inspections.

D. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A.

3.04 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 26 24 16
PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Receptacles, receptacles with integral GFCI, and associated device plates.
   2. Twist-locking receptacles.
   3. Wall switches.
   4. Isolated-ground receptacles.
   5. Pendant cord-connector devices.
   6. Cord and plug sets.
   7. Floor service outlets, service poles, and multi-outlet assemblies.

1.2 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.
E. TVSS: Transient voltage surge suppressor.
F. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Receptacles for AAFES-Furnished Equipment: Match plug configurations.


1.6 EXTRA MATERIALS

A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Service/Power Poles: One for every 3, but no fewer than 10.

2. Floor Service Outlet Assemblies: One for every 5, but no fewer than 10.

PART 2 PRODUCTS

2.1 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, hand use, heavy duty, grounding type, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498. Bodies shall be ivory as per NEMA WD1, face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall be per NEMA WD6.

B. Provide screw-type, side wired wiring terminals. Connect grounding pole to mounting strap. The receptacle shall contain triple-wipe power contacts and double- or triple-wipe ground contacts.

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. UL 498, hard use, heavy duty, isolated grounding per NEMA WD1. Face and body shall be thermoplastic supported on a metal mounting strap. Dimensional requirements shall meet NEMA WD6. Provide screw-type side wired wiring terminals. The receptacle shall contain triple-wipe power contacts and double- or triple-wipe ground contacts.
2.2 GFCI RECEPTACLES
   A. General Description: Straight blade, extra heavy duty, tamper-resistant, duplex type for mounting in a standard outlet box, feed or non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A. Device shall be capable of detecting current leak of 6 milliamps or greater and tripping per requirements of UL 943 for Class A GFT devices. Provide screw type, side-wired wiring terminals or pre-wired pigtail leads. Provide with ‘push-to-test’ button and visible indication of tripped condition. All outdoor GFCI receptacles shall be marked weather-resistant. All receptacles shall have 10 KA short circuit current rating.

2.3 TWIST-LOCKING RECEPTACLES
   A. Single Convenience Receptacles, 125 V, 20 A and 250 V, 60A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, L22-30R, and UL 498.
      1. High-impact nylon face, with one-piece all brass contact with long spring arm and oxide cutting nibs.
      2. Provide twist-locking receptacles to match AAFES furnished equipment voltage, phase and amperage.

2.4 PENDANT CORD-CONNECTOR DEVICES
   A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade or as required to match AAFES furnished equipment. Coordinate voltage, phase and amperage with AAFES.
      2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.5 CORD AND PLUG SETS
   A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
      1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.

2.6 SNAP SWITCHES
   A. Comply with NEMA WD 1 and UL 20.
   B. Switches shall be rated quiet-type AC only, 120/277 V, 20 A with number of poles required. Totally enclosed single pole, three way, and four way switches with bodies of thermoplastic or thermoset plastic and mounting strap with grounding screw. Handles shall be ivory.
Thermoplastic wiring terminals shall be screw type, side-wired. Contacts shall be silver-cadmium and contact arm shall be one-piece copper alloy.

C. Pilot Light Switches, 20 A, Wired Handle:
   1. Provide pilot light adapter for 277 volt operation.
   2. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

E. Breakers used as switches are not allowed.

F. Special Purpose Switches: Switches used for disconnection purposes (small water heaters, duct heaters, circ pumps, exhaust fans, etc.) shall be same as wall switches. Switches must have a horsepower rating adequate for the motor being switched.

2.7 WIRING DEVICES

A. Wiring devices shall be from one of the manufacturer’s and of the types listed below:

<table>
<thead>
<tr>
<th>ITEM</th>
<th>HUBBELL</th>
<th>PASS &amp; SEYMOUR</th>
<th>LEVITON</th>
<th>COOPER</th>
</tr>
</thead>
<tbody>
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<td>20A GFCI (weather resis)</td>
<td>2095TRWRI</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>20A Single-Plex Recpt (I.G. )</td>
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<td>IG8301</td>
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<tr>
<td>20A Single Recpt (5-20R)</td>
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2.8 COMMUNICATIONS OUTLETS

A. Data Outlet:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
      a. Siemon CT-CT-05-02 blue in color for primary and yellow in color for secondary.
2. Description: Single 5E jacks for terminating 100 Ohm, balanced, four-pair UTP; TIA/EIA 568-B.1; eight pin, non-keyed; complying with Category 5e. Comply with UL 1863.

B. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the work include, but are not limited to, the following:
   a. Siemon Ct-CT-05-02 white in color

2. Description: Single RJ-45 jack for 100 Ohm, balanced, four-pair UTP; TIA/EIA 568 B.1; eight pin, non-keyed; complying with Category 5e.

2.9 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Smooth, high-impact nylon or lexan 0.03-inch- (1-mm-) thick, satin-finished stainless steel, 0.04-inch- (1-mm-). Plates to be same color as device. Verify plate material with AAFES.
   3. Sectional type device plates will not be permitted.
   4. Material for Unfinished Spaces: Galvanized steel or smooth, high-impact nylon or lexan.

2.10 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, flap-type or above-floor, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular or round, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: One, two, or three modular, keyed, color-coded, RJ-45 Category 5e jacks for UTP cable.

2.11 SERVICE POLES

A. Description: Factory-assembled and field-wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor or in AAFES provided casework and displays.
   1. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling or to structure, and with separate channels for power wiring and voice and data communication cabling. Coordinate with AAFES final casework layout for poles with power only and poles with power and data and security wiring.
   2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to supports or structure supports; with pole foot and carpet pad attachment where pole extends to finished floor.
3. Casework Mounting: Custom length power poles into checkout, jewelry and electronic casework require two power circuits (one clean power, one dirty power) from these power poles. Make connections to receptacles and J-boxes in casework. The checkout, jewelry and electronics casework also require a data channel for data cabling and security duress alarm wiring. Power only service poles into AAFES provided freestanding casework require custom length pole in field to the 6 ft above floor connection point with two 20 amp duplex receptacles within 12” of top of casework.

4. Finishes: Custom painted finish to match AAFES requirements. Wilsonart frosty white #15-73-60 or current standard.

5. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 5e voice and data communication cables.


7. Voice and Data Communication Outlets: Two RJ-45 Category 5e jacks or as required per final AAFES store layout. Coordinate with AAFES store layout and Contracting Officer.

2.12 FINISHES

A. Color:
1. Wiring Devices Connected to Normal Power System: Ivory or as selected by AAFES, unless otherwise indicated or required by NFPA 70 or device listing.
3. Isolated-Ground Receptacles: Orange or with orange triangle on face. Orange devices required for clean power to all checkout counters.

2.13 USB CHARGER RECEPTACLE.

A. General description: straight blade, extra heavy duty, tamper-resistant, duplex type with two (3.0AMP) USB charging ports, with extra deep mounting box. Complete with USB BC1-2, UL-498, and UL1310. Outlet with green LED indicator to show USB power available.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
1. Mounting Heights:
   - Switches: +48” to top of J-box
   - Receptacles: +18” to top of J-box.

B. Coordination with Other Trades:
1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls on the wall so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall or half in and half out of a tiled surface.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailling existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtaills for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening. Plate edges shall be parallel to wall junctions, door, windows, etc., and flush against the wall surface. All switches and receptacles shall be installed vertical unless in toe space or indicated otherwise.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.
H. Adjust locations of floor service outlets and service poles to suit arrangement of AAFES furnished partitions and furnishings.

3.2 IDENTIFICATION

A. Receptacles: Identify panelboard and circuit number from which served. Use machine printing with black lettering on white field. Use durable wire markers inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 26 27 26
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.
   3. Lighting fixture supports.

B. This performance specification section provides the minimum requirements for a complete and operating lighting system design, material and installation.

1.2 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

H. CCT: Correlated color temperature.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Ballast, including ballast factor and power factor.
   5. Life, output, CRI rating, CCT rating, color shift characteristics and energy-efficiency data for lamps.
   6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
a. Photometric data shall be certified by a manufacturer’s laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

7. Voltage rating.
8. Type of mounting.
9. Type of ceiling.

B. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Lighting fixtures.
2. Other items in finished ceiling including the following:
   a. Air outlets and inlets.
   b. Speakers.
   c. Sprinklers.
   d. Fire alarm/mass notification devices.
   e. Occupancy sensors.
   f. Access panels.
   g. Security cameras.

C. Qualification Data: For agencies providing photometric data for lighting fixtures.

D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

F. Substitutions: Approval of substitution requests may be contingent upon AAFES approval, furnishing sample fixtures for inspection, providing additional photometric data, such as point-by-point calculations or any or all of the above.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers’ laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.
1.6 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Interior Lighting Fixture Schedule where titles below a column or row headings that introduce lists, the following requirements apply to product selection:

   1. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Metal Parts: Free of burrs and sharp corners and edges. Metal Finishes: Provide manufacturer’s standard finish applied over corrosion resistant primer, free of streaks, runs, holidays, stains, blisters or similar defects. Remove any fixtures showing evidence of rust at time of final inspection.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: Is not permitted.

E. Plastic Diffusers, Covers, Louvers and Globes:

   1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

      a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum average unless different thickness is indicated.

      b. UV stabilized.
2. All fixtures installed in food preparation and over serving lines shall be provided with lenses.

3. Glass: Annealed crystal glass, unless otherwise indicated.

4. Straight blade louvers: Steel baffles perpendicular to the lamps providing shielding. Baffle to be 8" high and 1" on center spacing, painted with 90% reflective white paint.

P. Mounting Accessories: Fixtures shall be complete with all necessary accessories for installation, such as suspension hangers, canopies, plaster frames, spacers, etc. Where recessed fixtures are specified, it shall be the Contractor’s responsibility to coordinate the proper fixture type (flange, grid type, plaster frame, etc.) with the final type of ceiling construction to be installed. For suspended type luminaires, the hanger lengths (unless specifically indicated) shall be coordinated before ordering and installation. Provide swivel hangers for suspended fixtures attached to slope ceilings.

2.3 EMERGENCY POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with fluorescent ballast. Comply with UL 924, NFPA 101 and NEC Article 700.

1. Emergency Connection: Operate one fluorescent lamp continuously at an output of a minimum 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Night-Light Connection: Operate one fluorescent lamp continuously.

3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

   a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

   b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.


5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

8. The emergency lighting system to be designed with battery units to provide a maintained one footcandle (minimum) level of lighting throughout the designated path of egress. The battery unit shall provide a minimum 1350 lumen output for one T8 Octron (4 ft) lamp for a minimum duration of 90 minutes. Other manufacturers shall provide photometric data along with their submittal data to verify that the maintained one footcandle minimum light level is provided with.
the substitute battery unit. Should additional battery units be required to meet the specification requirements the contractor shall include such units in their bid.

9. Damp area battery units shall be Bodine BDL-500 or equal.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more LED lamps, remote mounted from lighting fixture. Comply with UL 924. Locate remote emergency battery units close as possible to light fixture in accessible location or provide access panels.

1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2. Night-Light Connection: Operate one fluorescent lamp in a remote fixture continuously.


5. Housing: NEMA 250, Type 1 enclosure.

6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.4 EMERGENCY LIGHTING UNITS

A. Description: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.

2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.

8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.5 LED LAMPS AND DRIVERS

A. All LED systems shall comply with LM-79 and LM-80 standards, and tested as a system.

B. LEDs shall have a minimum output of 75 lumens per watt (efficacy).

C. LEDs shall have a minimum rated life (L70) of 50,000 hours. After 50,000 hours, LEDs shall have a minimum of 70% of the initial rated lumen output.

D. LED diodes shall be manufactured by Cree, Nichia, Lumiled, or Osram.

E. LED drivers shall be by Phillips Advance or Osram.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.


E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
PART 3 - EXECUTION.

3.1 INSTALLATION

A. Lighting Fixtures: Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer’s written instructions, applicable requirements of NEC, NECA’s ‘Standard of Installation’, NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with the ceiling grid, sprinkler system, mechanical ductwork, plumbing and electrical conduit, boxes, cabling, etc., in the ceiling space to properly interface the installation of interior lighting fixtures.

C. Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

D. Suspended Lighting Fixture Support:

1. Securely mount all fixtures, provide all additional hangers and supporting brackets, including canopies, stem suspensions or proper lengths, etc., as necessary to securely fasten and support fixtures. All hangers shall support a weight equivalent of three times the weight of fixture supported. Recessed fixtures are to be secured to ceiling framing to comply with NEC 410-16b.
2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
4. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
5. Aircraft Cable Suspension: Provide cord clips to attach the power cord to the cable securely and in an orderly manner.

E. Connect wiring according to Division 26 Section ‘Low-Voltage Electrical Power Conductors and Cables’.

F. Junction Boxes:
1. All junction boxes shall be accessible per NEC requirements. The Contractor shall coordinate the box locations with duct work, piping and the ceiling type. Boxes located above suspended gypboard ceilings are not considered accessible, unless access panels are provided.

3.2 FIELD QUALITY CONTROL.

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.3 LAMP DISPOSAL.

A. Any lamps that must be removed from existing fixtures shall be properly disposed of or recycled through an approved lamp recycler. Contractor shall contact the local jurisdiction for acceptable lamp disposal. All lamp disposal shall be considered inclusive in the contract.
B. Ballast Disposal: If present, polychlorinated biphenyls (transformer, lighting ballasts) must be surveyed, removed and disposed of following regulatory requirements. Submit abatement/waste management plans to local jurisdiction.

3.4 ADJUST AND CLEAN.

A. Immediately before final inspection, thoroughly clean all fixtures inside and out including plastics and glassware, adjust all trim, replace broken or damaged parts, lamp and test all fixtures for electrical and mechanical operation. Replace all non-operative lamps and/or ballasts. Noisy ballasts are to be replaced. Replace scratched or marred diffusers.

B. Protect installed fixtures from damage during construction period.

3.5 GROUNDING.

A. Provide tight equipment grounding connections for each interior lighting fixture installation.

B. Ground conductors in the following applications shall be listed for use as ‘fixture wire’ with a temperature rating equal to that used in the particular fixture and capacity equal to the branch circuit protection.

   1. Channels in fluorescent fixtures used as a raceway.
   2. In conduit to first junction outside fluorescent fixture channel.
   3. In flexible conduit from fixture to associated junction box.

END OF SECTION 265100
SECTION 28 31 00
FIRE ALARM SYSTEM / LIFE SAFETY SYSTEM

PART 1 GENERAL

1.1 DESCRIPTION

A. Provide all design, equipment, installation and testing for the system herein described and obtain the Authority Having Jurisdiction’s acceptance.

B. Quantity or Placement of Devices: This specification makes no representation to the quantity or location of devices required to satisfy the authority having jurisdiction. It is the responsibility of the Contractor to coordinate with the Authority Having Jurisdiction to ensure that the completed installation satisfies all requirements of the governing codes.

1.2 SIGNAL SUBCONTRACTOR

A. The Signal Subcontractor shall submit written certification that the proposed fire alarm system complies with the following. These certifications shall accompany submittals:

1. Compliance with NFPA Standards 72, 101 and 110 as applicable. The design, engineering and construction will be in accordance with Unified Facilities Criteria (UFC) 4-740-06 and UFC 3-600-01.

2. All equipment installed in the system including the interconnecting wiring is UL listed for the purpose and appropriately cross listed.

3. UFC 4-021-01 Compliant Mass Notification/Life Safety System.

B. A proposed maintenance agreement contract for this project shall be included with submittals indicating:

1. The installation is covered by a maintenance agreement between the Government and a UL listed fire alarm company whereby the service company issuing the certificate bears responsibility for inspecting, testing, maintaining, and providing any necessary repairs.

2. Documentation is maintained on the alarm system including description of system operation, location of alarm equipment throughout the area protected, initial acceptance tests and the performance of periodic testing and maintenance.

3. An executed maintenance agreement for the system shall also be forwarded to the Contracting Officer, upon certification of this fire alarm system, for the Contracting Officer’s consideration in selecting a system maintenance and confidence testing fire alarm company.

C. Authority Having Jurisdiction: The Authority Having Jurisdiction for this project is to be determined by the Contractor.

1.3 LISTING REQUIREMENTS
A. Listing Requirements: All fire detection and alarm components furnished under this section shall be UL listed in the fire equipment list or FM, approved for fire signaling or fire suppression use. All accessory equipment shall be manufactured with UL listed components.

B. Reference Standards (Edition currently adopted by Authority Having Jurisdiction):

- NFPA 72       National Fire Alarm Code
- UFC          Uniform Fire Code
- UFC 4-021-01  Mass Notification Systems, Unified Facilities Criteria (UFC)
- UFC 3-600-01  Fire Protection Engineering for Facilities Unified Facilities Criteria (UFC)
- NFPA 70       National Electrical Code with local amendments
- NFPA 110      Standard for Emergency and Standby Power Systems
- UMC          Uniform Mechanical Code (duct smoke detectors) with local amendments
- ADA          American Disabilities Act

1.4 DRAWINGS AND DOCUMENTATION

A. Fire Alarm / Mass Notification System Drawings:

1. The Contractor shall evaluate, evacuate and prepare a voice system design as required for proper detection and alarm annunciation consistent with the characteristics of the products he proposes to incorporate into the system.

2. Contractor shall prepare a design which includes all design equipment and installation necessary to obtain Authority Having Jurisdiction acceptance.

B. Submittal Data:

1. Design and Installation Drawings:

   a) Drawings shall be reproduced electronicaclly in digital format in DXF format on 24”x36” velum plots or approved equal. Submitted drawings shall have Authority Having Jurisdiction approval marked thereon. Layout plan drawings, interconnect drawings, and wiring diagrams submitted without Authority Having Jurisdiction approval will not be reviewed.

   b) Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility all other systems interfacing with the fire alarm system.

   c) Identify on the drawings the Class A raceway system and conductor sizes and types with number of conductors in each conduit. Provide each raceway and device with a unique alphanumeric identification.

   d) Indicate on the point to point wiring diagrams, interconnecting wiring within the panel between modules, and connecting wiring to the field device terminals.
e) Designs of attachments to building structure shall meet the requirements of UBC, Seismic Zone as directed by Authority Having Jurisdiction. Submit detailed mathematical analysis of the design.

f) Interconnect Drawings: Show only external connections between equipment and devices. All wires shall be identified with alphanumeric designators and all termination points shall show the correct terminal identification.

g) Wiring Diagrams: Show the general physical arrangement of the component parts of the equipment and the connection of all internal wiring. All components, wires, terminal strips and terminals shall be identified with alphanumeric designators. Wiring system shall be Class A.

h) Equipment mounting details: Show the mounting location for all floor and wall mounted equipment including distance from floor and column lines, and fabrication details for all special mounting brackets. Details shall also provide any special installation instructions. These details may be included on the plan drawings if space allows.

i) Layout Plan Drawings: Show every device provided under this section in its relative spatial location. Sections and elevations shall be utilized as necessary to accurately describe the installed location of all devices.

2. Provide voltage drop calculations indicating the system ability to furnish power at a minimum of 90 percent of nameplate listing in a standby power condition with all devices in alarm utilizing the proposed wire type and size. It shall be demonstrated that no single wire run between a circuit and its most remote device exceeds the manufacturers recommendations for wire length, circuit resistance or circuit wire to wire and wire to ground capacity.

3. Itemize all battery loads under standby and alarm conditions. Auxiliary power supplies and transponder battery calculations shall demonstrate the ability of the batteries to supply the required secondary power for a period of twenty four hours with no external power applied and furnish power for worst case alarm signaling for five minutes at the end of this period with all devices in alarm and all device LED’s lighted. Battery sizing shall be at a factor of 1.5 times the results of this mathematical requirement to account for battery aging between replacements and for system modifications and expansions.

4. Catalog sheets: Show the color, configuration and dimensions of the equipment or device described. Provide technical specifications, such as operating voltage, operating temperature and humidity limitations, mounting and wiring information and a description of the function and operation of the device.

5. Recommended Spare Parts List: Submit a listing of all devices and components recommended for Contracting Officer purchase as spare parts to support the system herein. The list shall include recommended quantities for all items. Unit prices guaranteed for 90 days after submittal shall be listed for all items.

6. Scheduled Testing: Include step-by-step procedures for performance testing every fire alarm device and system output to demonstrate functionality in accordance with specification requirements.

7. Operation and Maintenance Manuals: Refer to Division 26, Section ‘Common Work Results for Electrical Systems’. Manuals shall be typewritten or printed instructions which contain the following minimum information:

   a) Complete operating instructions
   
   b) Preventative maintenance instructions
   
   c) Catalog sheets on all devices and equipment
   
   d) Manufacturers operation and maintenance instructions
e) Reduced 11"x17" copies of all system drawings

8. Record Drawings: All review drawings shall be revised to reflect the accurate As-Built condition. Working plans shall show actual, accurate locations of devices, and actual routing of conduit and location of end of line devices. The Contractor shall provide five sets of vellum plots and three electronic CD’s of the Record Drawings.

1.5 DESIGN REQUIREMENTS

A. The system shall provide for multiple zones of alarm including the following:

1. Sprinkler water flow and tamper switch(es)
2. Smoke detection
3. Heat detection
4. Cooking hood fire suppression
5. Other fire suppression systems
6. Manual pull stations
7. Spares
8. Mass Notification
9. Class A Wiring System in ¾” conduit
10. Provide other additional zones as required by Authority Having Jurisdiction
11. Provide single mode 2-strand fiber optic cable to fire alarm cabinet from Base demarc backboard in inner duct within 1” conduit, per facility standards.
12. Reader boards shall be electronic at all exit door locations.
13. Provide wireless transceivers for reporting all zones to facility Fire Department with 12 spare zones.

B. Thermal detectors:

1. Shall be provided to detect a high temperature condition in required areas.
2. Thermal detectors shall be located in accordance with guidelines in NFPA 72E or manufacturers UL (or FM, if applicable) listed spacing.
3. Thermal detectors shall not be installed immediately above heating appliances.
4. Thermal detectors, rated as required, shall be provided to detect a high temperature condition in ceiling and roof structure cavities as required by code authority.

C. A combination of ionization and photoelectric detectors shall be provided to detect fire conditions in the required areas. Detectors shall be installed where required by the Authority Having Jurisdiction. Detectors shall be located in accordance with the NFPA guidelines on the spacing not to exceed 30 lineal feet and 900 square feet.

D. A rechargeable battery supply shall be provided to automatically operate the entire fire detection and alarm system, including detectors, control panel, remote fire annunciator, alarm sounding devices and auxiliary control equipment (unless otherwise specified herein) in the event of a loss of primary power for 72 hours. The batteries shall be sized at 150 percent of size prescribed by code.

E. Manual fire alarm stations, connected to alarm zones, shall be provided as required by the Authority Having Jurisdiction.

F. Audible and visual evacuation alarms shall be provided as required by the Authority Having Jurisdiction and comply with ADA requirements. All notification appliance circuits shall be Class A, Style Z. All notification appliance circuits shall have a minimum circuit output rating of 2 amps at 24 V dc; 50 watts at 25 V audio and 35 watts at 70 V audio. The notification circuits shall be power limited.
G. Remote fire annunciators shall be provided and installed to individually annunciate alarms for each of the fire zones, and a fire alarm control panel (FACP) trouble condition.

H. Provide a weatherproof audible and visual evacuation alarm (95 dB at 10 feet minimum) on building exterior at side of building directed by the Authority Having Jurisdiction.

I. Provide automatic releases for all doors as required by the Authority Having Jurisdiction. Connection to door hardware shall be made as directed by door hardware manufacturer. Coordinate device requirements with doors, hardware, and adjacent mounting surfaces to assure that doors are held in a position acceptable to the Contracting Officer and Authority Having Jurisdiction.

J. System shall be capable of remote monitoring at either a monitoring station or the fire department. Coordinate the interface requirements with the Contracting Officer. Provide remote radio transmitter per Government requirements.

K. Interfaces between air handling and fire suppression systems and the fire alarm system shall be accomplished utilizing interposing relays with a dry contact. See requirements in Divisions 23 and 26. Provide for each zone of alarm and duct detector that actuates in an alarm condition. Coordinate with Divisions 23 and 26 to insure proper sequencing of air handling and fire suppression systems.

L. Provide interface to the mass notification panel to shut down the fire alarm signals both audible and visual, upon a mass notification alarm condition. During any mass notification alert message, the fire alarm horns/strobes shall be silenced so that the mass notification message can be heard throughout.

1.6 SYSTEM OPERATION

A. Activation of any alarm causing device (manual station, smoke detector, water flow switch, heat detector, etc.) shall cause the following actions and indications:

1. Initiate a pre-signal alarm at main control panel, and begin a time delay sequence. If the staff can confirm that the alarm is false, the general alarm shall be cancelled. If the alarm condition is valid, the general alarm shall be initiated after the time delay.

2. Indicate the fire device and/or fire zone on remote annunciators and/or graphic annunciators.

3. Initiate shut down and/or start of supply and exhaust fans through the interposing relays to evacuate or restrain smoke movement.

4. Energize extinguishing systems for containment of the fire where appropriate.

5. Close all fire doors, smoke doors, and fire dampers.

6. Activate the off site alarm (central reporting).

B. Activation of any supervisory condition causing device (tamper switch, valve supervision device, fire pump trouble, generator trouble, low temperature thermostat, low water level) shall initiate a supervisory alarm signal at main control panel, and remote annunciators.

C. Any system trouble caused by wiring failure including open circuits, grounded circuits and shorted circuits on circuitry required to be supervised in this manner; communications loss, device removal, battery low voltage, power loss, charger failure or failure in any device shall cause the following actions and indications:

1. Initiate a fire alarm system trouble signal at the fire alarm control panel.
2. Indicate a trouble condition at remote annunciators and/or graphic annunciators.

D. All signal circuits including evacuation circuits, trouble circuits and supervisory indicating circuits, but not including water flow indication circuits, shall be acknowledged by means of a switch on the control panel front. Subsequent alarm receptions shall cause the alarm signals to resound indicating the reception of a new alarm condition. The signals shall also be caused to resound by the re-operation of the signal silence switch allowing evacuation signaling from the silence switch without keyboard commands when an alarm condition exists.

E. Labels: Indicating lights and controls shall be permanently labeled as to their function.

1.7 ACCEPTANCE TEST PROCEDURE

A. Submit for approval, prior to testing, an acceptance testing procedure meeting the requirements of this section.

B. Submit, for system record, all required data as compiled during installation and testing upon completion of the acceptance testing procedure. This data shall be loose-leaf bound and labeled as system acceptance testing information.

C. Submit for system record, a completed ‘fire alarm/mass notification system certification and description’ as included in NFPA 72, 2007 Edition.

PART 2-PRODUCTS

2.1 EQUIPMENT

A. All equipment shall be new and the latest state of the art equipment as marketed by a single manufacturer. The equipment shall be installed in a fashion consistent with the listings to perform all functions and indications as described herein. All equipment shall be listed for fire alarm system use by the UL or listed by FM. The system shall be comprised of all equipment, software, firmware, raceways, wire and wiring as required to furnish a complete and operating system in full compliance with this specification and the contract documents.

B. Fire Alarm /Mass Notification Control Panel: The FACP shall be the addressable type and modular in construction and shall be comprised of but not limited to the hardware, and software required to perform the required functions. The fire alarm control panel shall consist of:

1. Surface mounted steel cabinet with indicator viewing window, hinged door and cylinder lock, factory finished in baked enamel.

2. System power supplies, including necessary transformers rectifiers, regulators, filters and surge protection as required for system operation, capable of powering the system in a worst case condition with all devices in an alarm condition and local alarm devices lighted without exceeding the listed ratings.

3. System processors capable of processing all incoming alarm signals and issuing any output commands required as a result of the alarm reception.

4. Emergency power supply batteries shall be sealed, gelled-electrolyte, designed for fire alarm service.

5. A completely automatic, solid state battery charger shall be provided to maintain the batteries in fully charged condition. The charger shall be capable of charging the batteries from 75 percent of full charge to 100 percent of full charge within 24 hours.
6. Common module shall supply the power necessary for the FACP and all detectors that require power. A green AC power-on LED shall indicate the normal condition of the system. Common alarm and trouble LEDs, voltage outputs, and relays shall be provided. Individual yellow supervisory LEDs shall be provided for primary AC power failure indication, ground fault detection, reverse polarity feature disconnect, low battery voltage, indicating circuit trouble. An audible trouble signal shall sound when any trouble condition occurs. A silence switch shall be provided to silence the audible signal but the trouble LEDs shall remain lighted until the trouble condition is repaired and the system is reset. To prevent the silence switch from being inadvertently left in an abnormal position, the switch shall be self-restoring and any new trouble occurrence shall reinitiate the audible signal.

7. System ground fault detection shall be provided for the entire FACP. Upon detection of a resistance to ground indicating deterioration of the circuit, the common trouble signal shall be activated and the ground fault LED shall light. Fault conditions shall be designated style D for initiates devices and Style 6 for signaling circuit.

8. Provide a reverse polarity circuit that is a distinct circuit utilized for no other purpose. A reverse polarity switch shall be provided for system testing. The reverse polarity yellow LED shall light whenever the reverse polarity circuit is disconnected and a trouble signal shall be indicated. Output terminal connections shall be provided for a central station transmitter. Transmitter is not part of this contract and shall be supplied by the Owner. Provide wire in conduit to the telephone panel.

9. Accessory relay module shall have relays suitable for fan shutdown, damper positioning, and door holder release. Relays shall have a minimum contact rating of five amperes, resistive, at 120 volts AC or 28 volts DC. Screw terminals for wiring terminations shall be provided.

C. Monitoring and Control: The fire alarm control panel shall include the following capabilities and features:

1. Detector real time condition readout in an analog value to allow tracking of detector condition and maintenance. Scheduling as well as performing required NFPA calibrated sensitivity testing. Detectors reaching a pre-defined percentage of the individually programmed alarm setting and maintaining that setting for a period of 24 hours shall display an alarm message to indicate the need for maintenance.

2. The ability to individually assign any automatic smoke detector to perform an alarm verification cycle as defined by the UL to eliminate false alarms as a result of transitory environmental smoke, electrical transients all system processors to accomplish an automatic restart if required, generate a trouble message and revert to the default, stand alone mode if necessary.

D. Remote Annunciators: Remote annunciator panels shall provide visual indication and be dead front construction with nomenclature for alphanumeric annunciator applied with a photo emulsion technology and finish trim in anodized aluminum. Locate adjacent to entry designated by Authority Having Jurisdiction for fire department use. Provide an indicator for each zone. Provide additional indicators as required by the Authority Having Jurisdiction.

E. System Power:

1. Primary power for the FACP and the secondary power battery chargers shall each be obtained from the power panelboard. Connect primary power circuit to emergency generator if available.

2. Secondary Power Supply:

   a) Provide sealed gelled electrolyte batteries as the secondary power supply for the fire alarm control panel and each system transponder. The battery supply shall be calculated to operate its load in a supervisory mode for a period of 72 hours with no primary power applied and at the end of that period operate its alarm mode for a period of fifteen minutes. Batteries shall be sized to carry 1.5 times the calculated size to compensate for deterioration and aging during the battery life cycle. Batteries shall be housed in the control cabinet or a separate cabinet with adequate cell separation.
to prevent accidental discharge. Batteries shall be equipped with post and nut or one blade terminals. Slip on tap terminals are not acceptable. If housed in a separate cabinet, a fuse block shall be provided within the battery cabinet.

b) Provide battery charging circuitry for each standby battery bank in the system low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. Battery charge rate and terminal voltage shall be read using the fire alarm control panel LCD display in the service mode and indicated directly in volts and amps. Meters reading in percentage are not acceptable. Charger shall be housed in the main fire alarm control panel or the battery cabinet.

F. Manual Stations: Provide double action type with no break glass/plastic bar feature, keyed flush or surface mounted devices as required. Station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Devices utilizing rotary switches, pins, jumpers or staples are not acceptable. Surface mounted stations shall be mounted using a baked red enamel outlet box. Manual pull boxes shall open with a screwdriver or an Allen wrench.

G. Heat detectors shall be rate compensated type, rated at 135 degrees (except where noted otherwise). Detectors shall be constructed to compensate for the thermal inertia inherent in detectors due to the thermal mass, and alarm at the set point. Detector bases shall be of the twist lock style and shall be provided with an indicating light to verify operation which shall latch on in an alarm condition and screw type pressure terminals for the connection of field wiring. Removal of the detector from its base shall cause a system trouble signal. Devices utilizing rotary switches, pins, jumpers or staples are not acceptable.

H. Photoelectric Smoke Detectors: Light refraction technology smoke detectors shall have a high rejection of false signals caused by electrical noise and electrical transients and shall be capable of being checked for sensitivity without being removed from its twist lock base. The reading of the detector sensitivity shall yield a discrete electrical value for logging and tracking of status to determine the maintenance and cleaning requirements. Detectors not yielding a calibrated value indicating sensitivity shall not be acceptable. The detector shall be readily dissembled to gain access to the detection chamber for cleaning and maintenance. Detectors shall be used for open area protective coverage and shall be insensitive to air velocity.

I. Ionization Smoke Detectors: Dual chamber and self-compensating for ambient temperature and humidity and shall be capable of being checked for sensitivity without being removed from its twist lock base. The reading of the detector sensitivity shall yield a discrete electrical value for logging and tracking of status to determine the maintenance and cleaning requirements. The detector shall be readily dissembled to gain access to the detection chamber for cleaning and maintenance. Detectors shall be used for open area protective coverage and shall be insensitive to air velocity.

J. Duct Detectors:

1. Air duct smoke detectors shall be sampling photoelectric or ionization type for sensing of products of combustion within the air stream of ducted fan systems. The devices shall include necessary sampling tube extensions and sensitivity adjustments for detection of products of combustion across the width of the duct. The device shall actuate upon nominal two percent light obscuration per foot. Visual indication of normal and alarm/trouble shall be incorporated into the exposed surface of the device. Auxiliary contacts shall be provided for connection to stop the respective fan system. Wiring for fan shut down shall be installed by the Contractor.

2. The detectors furnished shall be approved for use in environments as covered by FM, UL 268a and UL 268. Detectors furnished shall be available in the following configurations to serve all possibilities:

a) High Velocity: As listed for use in HVAC duct detection applications of air velocities of up to 1200 feet per minute.

b) Low Velocity: As listed for use in HVAC duct detection applications of velocities between 500 and 4000 feet per minute.
3. Detector bases are to be low profile twist lock type with screw clamp terminals and self-wiping contacts. A security lock shall be installed in those areas where indicated on the drawings as requiring tamper resistant installation. Bases shall be capable of installation on a four inch square or octagonal electrical outlet box. The detector base shall be equipped with an indicating LED that shall flash to indicate system communications and shall change state to a steady ‘on’ when the detector reaches the selected threshold for alarm and communicates that alarm to the system. The specified LED functions shall indicate detector state whether the system is in the normal mode or the standby power mode. Removal of the detector from the base shall cause a system trouble condition with and display a distinctive trouble code on the control panel display indicating the zone of the trouble condition.

K. Evacuation Alarm Signals:

1. Evacuation alarm devices shall be combination ceiling mounted speakers and white strobe lights to provide both audible and visual indications. All notification appliance circuits shall be Class A, Style Z. The notification circuits shall be power limited.

2. Provide flush ceiling speakers and outside wall mounted speakers for audible alarm generation. Sound pressure levels shall comply with applicable codes and shall satisfy the Authority Having Jurisdiction.

3. Provide a strobe type integral with assembly. Intensity per ADA requirements.

4. The device shall be fully enclosed, heavy duty, suitable for mounting on a standard four inch square outlet box.

5. Network Wiring: The system supplied shall utilize node-to-node, direct-wired multi-priority peer-to-peer network operations. The system shall utilize independently addressed, output modules. The peer-to-peer network shall contain multiple nodes consisting of the main controller, remote control panels and LED/LED nodes. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communication failures between nodes.

L. Smoke Door Release Mechanisms: Where required by the Authority Having Jurisdiction, provide combination door closer/holder as a separately mounted device. Electrical characteristics of door holder mechanisms shall be coordinated for proper operation of magnetic release from fire alarm system. Manual override release shall be possible at any time.

M. Remote Indicators: Indicator (LED or lamp) mounted in escutcheon plate for flush mounting in ceiling or wall. Normal condition shall be compatible with area smoke detector indicators (i.e. illumination upon alarm, extinguish upon return to normal).

N. Spare Parts: Deliver the following:

1. One zone module of each type
2. Two of each type of detector
3. One manual pull station
4. One alarm horn/strobe unit

PART 3-EXECUTION

3.1 INSTALLATION

A. The installation of the system shall meet all requirements of NFPA 70.
B. Breakers in the panels feeding the control panel shall be fitted with suitable guard, such that the breaker cannot be turned off but fixed so the breaker can trip and requiring the removal of a screw to remove the guard. Separate breakers shall be provided for each control panel main power and trouble circuits. Breakers shall be lockable in ON position.

C. Conductors shall be copper and shall be of the type and AWG size to Authority Having Jurisdiction.

D. Provide adequate evacuation alarm devices for appropriate signal level throughout building.

E. Remote Indicators: Provide in an adjacent area where readily visible for all concealed detectors.

F. General smoke Detector spacing: Smoke detector spacing shall be in accordance with the listed spacing, the manufacturers recommendations and the requirements of NFPA 72E. Detectors shall not be located within five feet of a supply air register nor within twelve inches of a lighting fixture.

G. Duct smoke Detector Location:
   1. Location shall be in accordance with the listed spacing, the manufacturers recommendations and the requirements of NFPA.
   2. Coordinate installation of detectors with sheet metal installer for mounting; electrically connect and provide remote indicator lights (for duct smoke detectors) where the detector is located above a suspended ceiling or in an area which is not readily accessible. Coordinate interposing relay operation to shutdown fan system.

H. Visual Indicators: Locate to meet ADA requirements and be ceiling mounted.

I. Devices: Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

J. Wiring:
   1. Within sub-panels: Shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.
   2. Terminals: Spade lugs with upset legs and insulation sleeves sized for the conductors.
   3. Each conductor shall be identified as specified herein with wire markers at every splice and terminal point. Attach the wire markers within two inches of the wire termination. Mark both ends with alpha-numeric wire markers.
   4. Raceways carrying notification and Class A fire alarm signals shall have supply and return conductors installed in separate conduits and be identified by color coding. Paint coverplates of fire alarm J-boxes red. In ceiling spaces and other unfinished areas, apply red paint to the raceway at ten foot intervals to identify the raceway as fire alarm. All wiring shall be in conduit.
   5. Voltages shall not be mixed in any junction box, housing, or device, except those containing power supplies and control relays. Electrical metallic tubing conduit is acceptable in dry locations not enclosed in concrete or where not subject to mechanical damage. Conceal conduit in finished areas of new construction and wherever practicable in existing construction. The use of flexible conduit not exceeding a 6 foot length shall be permitted in initiating device circuits. Run conduit or tubing concealed unless specifically shown otherwise on the drawings. Shielded wiring shall be utilized where recommended by the manufacturer. For shielded wiring, the shield shall be grounded at only one point, that shall be in or adjacent to the FACP. Pigtail or T-tap connections to signal line circuits. Initiating device circuits, supervisory alarm circuits, and notification appliance circuits are prohibited. Color coding is required for circuits and shall be maintained throughout the circuit. Conductors used for the same functions shall be similarly color coded. Wiring shall conform to NFPA 70.
6. Conductor Terminations: Labeling of conductors at terminal blocks in terminal cabinets, and remote control units shall be provided at each conductor connection. Each conductor or cable shall have a shrink-wrap label to provide a unique and specific designation. Each terminal cabinet and fire alarm control unit shall contain a laminated drawing that indicates each conductor, its label, circuit, and terminal. The laminated drawing shall be neat, using 12 point lettering minimum size, and mounted within each cabinet, panel, or unit so that it does not interfere with the wiring or terminals. Maintain existing color code scheme where connecting to existing equipment.

3.2 TESTING

A. All test equipment, instruments, tools and labor required to conduct the system tests shall be furnished by the installing Contractor.

B. The Contractor shall use test instruments that bear valid calibration stamp showing date of calibration and the expiration date of the stamp. Calibration and accuracy of test instruments shall be certified by an independent testing laboratory having standards traceable to the National Institute of Standards and Technology.

C. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the local Authority Having Jurisdiction.

3.3 AUXILIARY CONTROLS

A. Conductors and power supplies of sufficient size shall be installed to minimize voltage drop consistent with the proper operation of all devices. Destructive link smoke dampers shall not be connected to the fire alarm system. Fan shutdown control circuits, smoke removal control circuits supervised (subject to NFPA requirements) and may be incorporated into the fire alarm raceway system, except that limited energy circuits shall be routed separately from line voltage circuits as required by Code (NEC Article 760).

3.4 CERTIFICATION

A. Following the final acceptance testing, the manufacturer’s representative shall submit a letter to the Contracting Officer with a copy to the Construction Manager stating he has inspected the system installation and found it in compliance with the manufacturer’s installation standards and acceptable in all respects.

3.5 ACCEPTANCE TESTING

A. A written acceptance test procedure for testing the fire alarm system components and installation will be prepared by signal subcontractor in accordance with NFPA 72 and this specification. The signal subcontractor shall be responsible for the performance of the acceptance test procedure, demonstrating the functionality of the system and verifying the correct operation of all system components, circuits, and programming.

B. A program matrix shall be prepared by the signal subcontractor, referencing each alarm input to every output function affected as a result of an alarm condition on that input. In the case of outputs programmed using more complex logic functions involving ‘any’, ‘or’, ‘not’, ‘count’, ‘time’, and ‘timer’ statements; the complete output equation shall be referenced in the matrix.

C. A complete listing of all device labels for alphanumeric annunciator displays and logging printers shall be prepared prior to the acceptance test procedure.
D. The signal subcontractor’s acceptance inspector shall use the system As-Built drawings in combination with the documents specified herein, during the test procedure to verify operation as programmed. In conducting the acceptance test procedure, the acceptance inspector shall request demonstration of any or all input and/or output functions.

E. Class A system wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:

1. Open loop
2. Shorted loop
3. Grounded loop
4. Open communication link
5. Shorted communication link
6. Grounded communication link
7. Open zone wiring
8. Grounded zone wiring
9. Open signal circuit wiring
10. Shorted signal circuit wiring
11. Grounded signal circuit wiring
12. Initiating device removal
13. Battery disconnected
14. Primary power disconnected
15. Connection to EMS system, where applicable

F. System evacuation alarm signaling shall be demonstrated as follows:

1. All signals actuate as programmed
2. Signal audibility

G. System indications shall be demonstrated as follows:

1. Correct message display for each alarm input
2. Correct annunciator light for each alarm input
3. System charging current shall be normal trickle charge for a full charged battery bank

3.6 DOCUMENTATION

A. System documentation shall be furnished to the Contracting Officer and Government and shall include but not be limited to the following:

1. The contractor shall maintain a set of drawings on site to record as-built construction. The drawings shall be updated on a daily basis and shall be available for review at all times. These drawings shall not be used for construction prints. As-built drawings shall show details of installation including conduit/cable locations, device locations, wire counts, equipment locations and such other details of construction required for a complete record of the construction. Upon completion of the construction the on-site as-built drawings shall be formally produced in a CAD format for turnover to the government as part of the required documentation package.

2. System operation, installation, maintenance and programming manuals.

3. System menu driven instructions for the alteration, addition or deletion of zones, modification, addition or deletion of zone messages and the modification, deletion or addition of logic modules as required for system operation.
3.7 MOUNTING HEIGHTS

A. Per ADA requirements, all mounting heights indicated are the distances from the finished floor level to the top of the device box:

- Manual Stations: 48"
- Speaker/Strobes: Ceiling/wall 84"
- Control Panel: 60" (depending on control panel)
- Annunciator: 60"

3.8 FIELD QUALITY CONTROL

A. Testing Procedures: Detailed test procedures, prepared and signed by a Registered Professional Engineer or a NICET Level 3 Fire Alarm Technician, and signed by representative of the installing company, for the fire detection and alarm system 60 days prior to performing system tests. Detailed test procedures shall list all components of the installed system such as initiating devices and circuits, notification appliances and circuits, signaling line devices and circuits, control devices/equipment, batteries, transmitting and receiving equipment, power sources/supply, annunciators, special hazard equipment, emergency communication equipment, interface equipment, Guard’s Tour equipment, and transient (surge) suppressors. Test procedures shall include sequence of testing, time estimate for each test, and sample test data forms. The test data forms shall be in a check-off format (pass/fail with space to add applicable test data) and shall be used for the preliminary testing and the acceptance testing. The test data forms shall record the test results and shall:

1. Identify the NFPA Class of all Initiating Device Circuits (IDC), Notification Appliance Circuits (NAC), Voice Notification System, and Signaling Line Circuits (SLC).

2. Identify each test required by NFPA 72 Test Methods and required test herein to be performed on each component, and describe how this test shall be performed.

3. Identify each component and circuit as to type, location within the facility, and unique identity within the installed system. Provide necessary floor plan sheets showing each component location, test location, and alphanumeric identity.

4. Identify all test equipment and personnel required to perform each test (including equipment necessary for testing smoke detectors using real smoke).

5. Provide space to identify the date and time of each test. Provide space to identify the names and signatures of the individuals conducting and witnessing each test.

B. Test States:

1. Preliminary Testing: Conduct preliminary tests to ensure that devices and circuits area functioning properly. Tests shall meet the requirements of paragraph entitled ‘Minimum System Tests’. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that panel functions were tested and operating properly. The letter shall include the names and titles of the witnesses to the preliminary tests. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

2. Request for Formal Inspection and Tests: When tests have been completed and corrections made, submit a signed, dated certificate with a request for formal inspection and tests to the Contracting Offices Designated Representative (COR).
3. Final Testing: Notify the Contracting Officer in writing when the system is ready for final acceptance testing. Submit request for test at least 15 calendar days prior to the test date. The tests shall be performed in accordance with the approved test procedures in the presence of the Contracting Officer. The Contractor shall furnish instruments and personnel required for the tests. A final acceptance test will not be scheduled until the operation and maintenance (O&M) Manuals are furnished to the Contracting Officer and the following are provided at the job site:

   a. The systems manufacturer’s technical representative

   b. Marked-up red line drawings of the system as actually installed.

   c. Megger test results

   d. Loop resistance test results

   e. Complete program printout including input/output addresses

4. The final tests shall be witnessed by the Contracting Offices Designated Representative (COR). At this time, any and all required tests shall be repeated at their discretion. Following acceptance of the system, as-built drawings and O&M Manuals shall be delivered to the Contracting Officer for review and acceptance.

C. Minimum System Tests: Test the system in accordance with the procedures outlined in NFPA 72, IEC 60849, IEC 60268-16. The required tests are as follows:

1. Megger Tests: After wiring has been installed, and prior to making any connections to panels or devices, wiring shall be megger tested for insulation resistance, grounds, and/or shorts. Conductors with 300 volt rated insulation shall be tested at a minimum of 250 VDC. Conductors with 600 volt rated insulation shall be tested at a minimum of 500 VDC. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

2. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the Contracting Officer and test results recorded for use at the final acceptance test.

3. Verify the absence of unwanted voltages between circuit conductors and ground. The tests shall be accomplished at the preliminary test with results available at the final system test.

4. Verify that the control unit is in the normal condition as detailed in the manufacturer’s O&M Manual.

5. Test each initiating and indicating device and circuit for proper operation and response at the control unit. Smoke sensors shall be tested in accordance with manufacturer’s recommended calibrated test method. Use of magnets is prohibited. Testing of duct smoke detectors shall comply with the requirements of NFPA 72.

6. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer’s O&M Manual.

7. Test both primary power and secondary power. Verify, by test, the secondary power system is capable of operating the system for the time period and in the manner specified.

8. Determine that the system is operable under trouble conditions as specified.


10. Test the battery charger and batteries.
11. Verify that software control and data files have been entered or programmed into the FACP. Hard copy records of the software shall be provided to the Contracting Officer.

12. Verify that red-line drawings are accurate.

13. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

14. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

15. Disconnect the verification feature for smoke sensors during tests to minimize the amount of smoke needed to activate the sensor. Testing of smoke sensors shall be conducted using real smoke. The use of canned smoke is prohibited.

16. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

17. Audibility intelligibility testing of the voice evacuation notification system shall be accomplished law NFPA 72 for voice evacuation systems, IEC 60268-16, and ANSI S3.2.

18. Opening the circuit at not less than 10% of alarm initiating devices and notification appliances to test the wiring supervisory feature.

19. The Contractor shall demonstrate modem communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.

20. The Contractor shall demonstrate fiber optic communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.

1.8 DRAWINGS, MANUALS, TOOLS AND SPARE PARTS

A. Upon completion of the installation and prior to final inspection, the contractor shall furnish ‘as-built’ drawings as indicated above. In addition, the contractor shall furnish five (5) copies of a manual, including wiring diagrams, giving complete instructions for the operation, inspection, testing and maintenance of the system. Any special tools necessary for the maintenance of the equipment shall be furnished, as well as one spare set of fuses of each type and size required. As soon as practicable after approval of the list of equipment, the contractor shall furnish copies of spare parts data for each different item of equipment listed. The data shall include a complete list of parts and supplies with current unit prices.

3.9 INSTRUCTION OF GOVERNMENT EMPLOYEES

A. Equipment manufacturer shall provide one day on site and five days of technical training to the Government at the manufacturing facility. Training shall allow for classroom instruction as well as individual hands on programming, troubleshooting and diagnostics exercises. Room and travel costs shall be included for two Government personnel. Factory training shall occur within six months of system acceptance.

B. Instructor: Include in the project the services of an instructor, who shall have received specific training from the manufacturer for the training of other persons regarding the inspection, testing, and maintenance of the system provided. The instructor shall train the Government employees designated by the Contracting Officer, in the care, adjustment, maintenance, and operation of the fire alarm and fire detection/mass notification system.

C. Qualifications: Each instructor shall be thoroughly familiar with all parts of this installation. The instructor shall be trained in operating theory as well as in practical O&M work.
D. Required Instruction Time: Provide eight hours of instruction after final acceptance of the system. The instruction shall be given during regular working hours on such dates and times as are selected by the Contracting Officer. The instruction may be divided into two or more periods at the discretion of the Contracting Officer. The training shall allow for rescheduling for unforeseen maintenance and/or fire department responses.

END OF SECTION 28 31 00