SHOPPING CENTER IMAGE UPDATE

SPECIFICATIONS
LUKE AFB, AZ
AAFES PROJECT NO. 4086-18-000005
May 31, 2019
DIVISION 0 - BIDDING REQUIREMENTS

00 04 04 Substitutions

DIVISION 1 - GENERAL REQUIREMENTS

01 10 00 Summary of Project
01 10 17 EXCHANGE Furnished and Installed Equipment
01 10 18 EXCHANGE Furnished Contractor Installed Equipment
01 10 42 Construction Phasing
01 10 60 Safety Policies and Procedures
01 13 00 Safety Regulations and Codes
01 13 00.1 Waste Disposal
01 14 40 Execution Requirements
01 14 50 Cutting and Patching
01 22 00 Unit Pricing
01 23 00 Options
01 25 00 Substitution Procedures
01 31 00 Project Management and Coordination
01 32 00 Construction Progress Documentation
01 33 00 Submittal Procedures
01 33 10 Weather Table
01 35 43 Environmental Protection
01 40 00 Quality Requirements
01 50 00 Temporary Facilities and Controls
01 51 00 Temporary Utilities
01 58 00 Construction Site Sign
01 65 00 Starting of Systems
01 71 00 Cleaning
01 77 00 Project Closeout
  Department of Defense Instruction
  DD Form 1354 Example
01 78 39 Project Record Documents

DIVISION 2 - EXISTING CONDITIONS

02 41 16 Selective Demolition

DIVISION 3 - CONCRETE

03 30 00 Cast-in-Place Concrete
03 35 36 Existing Facility Polished Concrete Floor Finish
03 35 40 Interior Concrete Slab Repairs and Joint Filler Replacement

DIVISION 4 - MASONRY – NOT USED

DIVISION 5 - METALS
05 50 00  Metal Fabrications

DIVISION 6 - WOOD, PLASTICS AND COMPOSITES
06 10 00  Rough Carpentry
06 40 00  Architectural Woodwork
06 60 00  Solid Surfacing Countertops

DIVISION 7 - THERMAL AND MOISTURE PROTECTION
07 54 23  Thermoplastic Polyolefin (TPO) Roofing
07 62 00  Flashing and Sheet Metal
07 84 00  Firestopping
07 90 00  Joint Sealants

DIVISION 8 - OPENINGS
08 11 10  Steel Doors and Frames
08 14 16  Flush Wood Doors
08 31 00  Access Doors
08 41 00  Aluminum-Framed Entrance and Storefronts
08 42 29  Automatic Entrance Doors
08 71 00  Door Hardware
08 81 00  Glazing
08 83 00  Mirrors

DIVISION 9 - FINISHES
09 22 16  Non-Load-Bearing Steel Framing
09 29 00  Gypsum Board
09 30 00  Ceramic Tile
09 30 10  Ceramic Wall Tile
09 51 13  Acoustical Panel Ceilings
09 65 13  Resilient Base and Accessories
09 65 19  Resilient Tile Flooring
09 68 13  Carpet
09 72 00  Vinyl Wall Covering
09 90 12  Interior Painting
09 90 31  Wood Stain and Transparent Finishes
09 97 00  Slatwall

DIVISION 10 - SPECIALTIES
10 14 00  Signage
10 21 13  Toilet Compartments
10 26 00  Impact-resistant Wall Protection
SPECIFICATIONS INDEX

PROJECT NUMBER 4086-18-000005

May 31, 2019

10 28 13 Toilet and Bath Accessories

DIVISION 11 - EQUIPMENT – NOT USED

DIVISION 12 - FURNISHINGS – NOT USED

DIVISION 13 - SPECIAL CONSTRUCTION – NOT USED

DIVISION 14 - CONVEYING EQUIPMENT – NOT USED

DIVISION 21 - FIRE PROTECTION SYSTEMS

21 00 00 Fire Protection

DIVISION 22 - PLUMBING SYSTEMS

22 00 00 Plumbing – General Provisions
22 05 00 Common Work Results for Plumbing
22 05 23 General Duty Valves for Plumbing Piping
22 11 16 Domestic Water Piping
22 11 19 Domestic Water Piping Specialties
22 13 16 Sanitary Waste and Vent Piping
22 13 19 Sanitary Waste Piping Specialties
22 40 00 Plumbing Fixtures
22 47 00 Drinking Fountains and Water Coolers

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS

23 00 00 HVAC – General Provisions
23 05 00 Common Work Results for HVAC
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 29 Hangers and Supports for HVAC Equipment
23 05 93 Testing, Adjusting and Balancing for HVAC
23 07 00 HVAC Insulation
23 09 00 Instrumentation and Controls for HVAC
23 23 00 Refrigerant Piping
23 31 13 Metal Ducts
23 33 00 Air Duct Accessories
23 34 23 HVAC Power Ventilators
23 36 00 Air Terminal Units
23 37 13 Diffusers, Registers, and Grilles
23 41 00 Particulate Air Filtration
23 73 13 Modular Indoor Central-Station Air-Handling Units
23 74 33 Packaged, Outdoor, Heating and Cooling Air Conditioners
23 81 26 Split-System Air Conditioners
DIVISION 26 - ELECTRICAL SYSTEMS

26 05 00 General Electrical Requirements
26 05 19 Building Wire and Cable
26 05 24 Manufactured Wiring Systems
26 05 26 Grounding and Bonding
26 05 29 Supporting Devices
26 05 33 Conduit
26 05 34 Boxes
26 05 35 Cabinets and Enclosures
26 05 36 Cable Trays
26 05 43 Underfloor Ducts
26 05 53 Electrical Identification
26 09 23 Electric Controls
26 09 25 Occupancy Sensors
26 12 16 Dry Type Transformers
26 24 16 Panelboards
26 27 13 Electrical Sensing and Measurement
26 27 26 Wiring Devices
26 28 13 Fuses
26 28 16 Enclosed Circuit Breakers
26 28 17 Enclosed Switches
26 29 13 Enclosed Motor Controllers
26 29 24 Enclosed Contactors
26 43 13 Surge Protective Devices (SPDs)
26 51 00 Interior Luminaires
26 60 00 Testing

DIVISION 27 - COMMUNICATIONS

27 10 00 Telephone Service, Raceways and Wiring
27 51 17 Mass Notification System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 16 00 Intrusion Detection
28 31 11 Fire Alarm

DIVISION 31 - EARTHWORK – NOT USED

DIVISION 32 - EXTERIOR IMPROVEMENTS – NOT USED

DIVISION 33 - UTILITIES – NOT USED
SPECIFICATIONS INDEX

PROJECT NUMBER 4086-18-000005

May 31, 2019

END OF TABLE OF CONTENTS
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
SECTION 01 10 00
SUMMARY OF PROJECT

PART 1 - GENERAL

1.1 PROJECT INFORMATION


B. Owner: Army and Air Force Exchange Service (AAFES).

1. AAFES Contracting Officer: Nikisha Knowlton, knowltonn@aafes.com.

C. Architect: Terry Lee Architect LLC, 6260 N Parsley Road, Tucson, AZ 85741; Terry Lee, 520-240-1664; tleearchitectllc@gmail.com.

D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:


2. Electrical Consultant: MW Engineering, LLC, David Watson, 2001 W Alameda Drive, Suite 102, Tempe, AZ 85282, 480-731-5050; davew@mwegroup.com.

E. AAFES Project Manager: Greg Porter; 214-312-4535; porterG@aafes.com.

F. Project Web Site: Administered by the EXCHANGE.

1.2 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.

B. The work to be performed is located at Luke Air Force Base, Arizona.

C. Principal Features:

1. The work to be performed in connection with this project includes, but is not limited to an Image Upgrade to an existing shopping center.

2. Retail Sales

   a. The Retail Sales area will be updated to include new floor and wall finishes to meet the current Exchange standards. Existing VCT will be removed and be replaced with a polished concrete floor. Existing carpet will be removed and replaced.

   b. Existing slatwall panels will be removed. Walls will be repaired to a Level 5 finish and painted. Wall at POS check out area will have Exchange Furnished / Contractor Installed vinyl wall graphics. Walls in clothing areas will have Exchange Furnished / Exchange Installed VIRA wall systems.
c. The existing acoustical ceiling tile and grid will be replaced.

D. The Contractor is advised to take note of the following General Provisions of the Contract: Cleaning up; Material and Workmanship; Accident Prevention; Protection of Existing Vegetation, Structures, Utilities and Improvements; Operation and Storage Areas; Site Investigation; Permits and Responsibilities. Copies of the General Provisions may be obtained from the Contracting Officer.

1.2 SPECIAL BASE REQUIREMENTS

A. The Exchange normal business hours of operation are from 9:00AM to 7:30PM, Monday through Saturday and 10:00AM to 6:00PM on Sundays. 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. Luke Air Force Base 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 51 00, “Temporary Utilities”.

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 Fire Regulations, as they relate to his work on base.

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.

B. 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 TESTS AND REPORTS

A. See Specification Section 01 40 00: Quality Requirements.

1.25 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, 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.

1.26 HAZARDOUS MATERIALS

A. Removal or disposal of toxic materials or asbestos is included in this contract, see Hazard Management Services, Survey and Asbestos and Lead Specifications. If the Contractor encounters additional materials, he shall immediately notify the Contracting Officer.

1.27 SUBMISSION OF PHOTOGRAPHS

A. Contractor shall submit to the Contracting Officer digital photographs taken on or about the first of every month, showing the general conditions of the work as viewed from the north, south, east, west and interior. Photographs (minimum of 20) must accompany each Application for Payment. Each print shall be identified by date of exposure, project title, and EXCHANGE Project Number, location and direction taken.

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. ‘Provide electrical connections to the ‘Retail Fixtures, EF/EI' where indicated on the drawings.
3. Provide custodial services for designated areas during use after beneficial occupancy.

1.2 DELIVERY DATE CHANGES

A. Requests by Contractor to change designated delivery dates shall be made in writing at least 30 days in advance of the designated delivery date. If the Contractor is not ready to accept delivery of EXCHANGE furnished property the Contractor shall be responsible for storage and redelivery cost. Should EXCHANGE be unable to effect the change, or should the Contractor fail to submit his request within the time stated above, the Contractor's obligation under this contract and as stated herein shall not be relieved and further, the Contractor will have no basis upon which he can file a claim under these conditions.

1.3 EXCHANGE ACTIVITIES AFFECTING PROGRESS OF WORK

A. Retail Sales Areas: Schedule date of installation of fixtures and possession of these areas 30 days prior to completion of project.

B. 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.
1.4 MATERIALS AND EQUIPMENT (EF/EI)

A. Equipment or material to be furnished and installed by EXCHANGE is as follows and as indicated on the Drawings:

1. All new store shelving and fixtures.
2. Check-out Fixtures and POS.
3. Interior graphic signage.
4. Office furniture.
5. Storage shelving.
7. Telephone system equipment.
8. Security equipment.
10. Retail Sales VIRA Wall fixtures and Cornice Lights.
11. Walk-in coolers and freezers (electrical and mechanical service, connections, lighting and fire protection by Contractor).
12. Food Concept equipment.
13. Mall services fixtures and equipment.

1.5 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 01 10 17
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 equipment 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 follows:

      1. EXCHANGE Furnished/Contractor Installed Items:

         a. Concept signage.

   C. Contractor's Duties:

      1. Designate required delivery date for each product. Notify the Contracting Officer in writing at least 60 days in advance of the date that EXCHANGE furnished equipment and furnishings will be needed.

      2. The equipment will be received at the job site by a representative of the EXCHANGE who will jointly, with the Contractor, verify condition and quantities. The representative will then effect receipted transfer of custody of the equipment to the Contractor.

      3. Unload, handle, store (on-site), protect, uncrate, assemble, install set in final position, align, join, level, and make all utility connections to all items of equipment. Installation shall be performed in accordance with the specifications, equipment plans, and schedules shown on the Drawings and the rough-in drawings provided by EXCHANGE.

      4. Construct all openings, furnish and install required sleeves and furnish and install all reinforcing, miscellaneous supports, angles, plates, anchors, and bolts necessary to secure EXCHANGE furnished equipment in place.

      5. Repair or replace items damaged as a result of Contractor's operations.

      6. Apply finish indicated, if any.

      7. The installation shall be complete in all respects, including mechanical and electrical hook ups, and put into good operating condition.

      8. Provide and install furring strips as required for installation of clipless wall system.

   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.

1.4 DELIVERY DATE CHANGES:

A. Requests by Contractor to change designated delivery dates shall be made in writing at least 60 days in advance of the designated delivery date. If the Contractor is not ready to accept delivery of EXCHANGE furnished equipment the Contractor shall be responsible for storage and delivery cost. Should EXCHANGE be unable to effect the change, or should the Contractor fail to submit his request within the time stated above, the Contractor’s obligation under his contract and as stated herein shall not be relieved and further, the Contractor will have no basis upon which he can file a claim under these conditions.

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
SECTION 01 10 42
CONSTRUCTION PHASING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Format.
B. Content.
C. Revisions to schedules.
D. Submittals.

1.2 RELATED SECTIONS

A. Exhibit “A” - General Conditions of the AAFES Contract for Construction, Article entitled: “Schedule and Progress”.
B. Section 01 10 00 - Summary of Project
C. Section 01 31 00 – Project Management and Coordination.
D. Section 01 33 00 - Submittals Procedures

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

A. Construction shall be phased and coordinated with the Contracting Officer in order to keep to a minimum, any disruption of, or interference with, the operation of the existing retail facility. The Contractor shall notify the contracting officer, within 15 days of notice to proceed, if any problems concerning specified construction phasing occur. Contractor shall submit, in accordance with Section 01 32 00, Contractors prepared progress chart system, a detailed schedule of work utilizing the priority and sequence of work shown on the Construction Phasing Plan. The Contractor shall keep the Contracting Officer advised of any anticipated changes in the work schedule in sufficient time to permit adjustment of store operations, without adversely affecting the ability of the commissary to function as necessary.

B. Schedule: The Contractor must submit the schedule, for review, to the Contracting Officer within 15 days after execution of a contract. Items specified herein are complementary to work items shown on the drawings schedule.

C. Beneficial occupancy inspection (finishes only) will be made at the end of each work item, to allow early access for fixture installations.

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 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.

1. Dust Barriers: Where dust barriers are required, provide a 6 mil fireproof clear polyethylene fiberglass reinforced film as manufactured by Griffolyn, or equal and if required provide temporary framework floor to ceiling, adequately braced 2" x 4" wood studs or metal studs. Tape all joints, and anchor framework as required for maximum stability.

2. Security Weathertight Barriers: Where security weathertight barriers are required, provide a temporary framework adequately braced metal studs with 1/2" plywood on the exterior side and 1/2" gypsum board or plywood on the interior, attached with screws, not nailed.

3. Doors in Barriers: Provide gates in barriers for the contractor's access to the work, of similar construction to the barrier in which it occurs. Gates shall be hinged, braced, and provided with types of locks in accordance with AAFES security. These shall be double high security padlocks.

4. Rope Barriers: Provide temporary barriers consisting of rope, sawhorses, and color flags to control areas as required.

1.6 MATERIALS:

A. All isolation valves and temporary ductwork used to keep system on line in occupied phases for mechanical systems (air-handling units, supply piping, water lines, sprinklers, and other similar items) shall be included by the Contractor at no additional cost to the Exchange.

1.7 GENERAL:

A. Site Preparation: Site preparation includes but is not limited to the relocation of utilities, the demolition of existing paved areas, regrading and paving to establish new parking areas, and the relocation and/or demolition of existing utilities as scheduled. Temporary construction barriers for site security must generally follow the project limit line.

1. Construction and Safety Fence: Enclose the contractor staging area with a 2.5 m (8-foot) high chain-link construction fence incorporating plastic fabric mesh screening (UV light resistant, dark brown, similar to tennis court screening) and include associated gate(s). Vinyl inserts are not allowed. The intent is to block construction activities from public view. The construction fence shall be supported and tightly secured to steel posts located on minimum 3 m (10 foot) centers either set in concrete or provided concrete block bases (depending upon anticipated heavy wind conditions). The Contractor shall also provide temporary safety fencing and warning signs at the construction site prior to the start of work to protect the public from immediate construction activities deemed hazardous. The safety fence will enclose those hazardous areas both within and outside of the visually-screened construction site. The safety fence, fabricated from high-density polyethylene grid (minimum 1.1m (42-inches) high, will meet OSHA and AFOSH color standards (typically bright orange for excavated trenches). The Contractor shall remove both the fence and screening from the work site upon completion of the contract.

B. 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.

C. Plumbing System:

1. Install all required piping and valves at the connection points. Shutdown of the plumbing systems to make necessary connections and extensions shall be accomplished at a time so as not to interfere with operation of the Exchange, and shall be of minimum duration. All proposed shutdowns of the plumbing systems shall be coordinated with the Exchange management.
D. Electrical Security Systems:

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

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 01 10 42
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 01 10 60
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 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 measures 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 CONTRACTOR 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>Cease 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>Cease Activity in area of discovery</td>
<td>Same as above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cover with plastic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buried Munitions</td>
<td>Cease Activity</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.
   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 Luke Air Force Base 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 Luke Air Force Base. Government will brief the Contractor on these requirements at the preconstruction conference.

D. Work areas in this Project may be classified as "permit-required confined spaces" or "non-permit required confined spaces." The Contractor’s Certified Industrial Hygienist will determine the confined space status of the Project areas. Regulations and procedures for entry into “permit-required confined spaces” are contained in 29 CFR 1910.146 and 8 AAC 61.010.14. The Contractor is responsible for ensuring the safety of his employees in confined spaces according to these regulations.

E. Confined Space Permit:

1. Provisions for confined space are outlined in 29CFR 1910.146 and ANSIZ117.1 1989 and shall be followed throughout Project.

2. Base Contact for information regarding confined Space issues is Ground Safety _______________. However, the Contractor shall process any permits required for confined space through his own safety Manager and Permit Space Program.

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

G. 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 Luke Air Force Base. 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" (Customer Service ________________) from Base 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 Civil Engineering Programs Flight Chief: ___________________________.

G. The Contractor shall notify the Fire Department 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>
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<td></td>
<td>Plastic rigid foam</td>
<td>Recovered material</td>
<td>9</td>
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<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>
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<td></td>
<td>Laminated paperboard</td>
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<td>100</td>
</tr>
<tr>
<td>Carpet</td>
<td>Polyester carpet face fiber</td>
<td>Excludes severe wear applications</td>
<td>25-100</td>
</tr>
<tr>
<td></td>
<td>Playground surfaces</td>
<td>Rubber or plastic</td>
<td>90-100</td>
</tr>
<tr>
<td></td>
<td>Running tracks</td>
<td>Rubber or plastic</td>
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<tr>
<td>Cement/Concrete</td>
<td>Concrete &amp; cement</td>
<td>Coal fly ash</td>
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<td>Concrete &amp; cement</td>
<td>Ground granulated blast furnace (GGBF)</td>
<td>25-50</td>
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<tr>
<td>Flooring/Patio</td>
<td>Patio blocks</td>
<td>Plastic or plastic blends</td>
<td>90-100</td>
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<td>Patio blocks</td>
<td>Rubber or rubber blends</td>
<td>90-100</td>
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<td>Floor tiles</td>
<td>Rubber</td>
<td>90-100</td>
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<td>Floor tiles</td>
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<td>Landscaping</td>
<td>Paper based hydraulic mulch</td>
<td>Postconsumer paper</td>
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</tr>
<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>
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</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 airflow in all hoods or branches.

1.8 USE OF IONIZING RADIATION (IR)

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

B. Submit request to the Base Radiation Safety Officer (RSO) with a courtesy copy to the Contracting Officer. Request shall include:

1. Description/Characteristics:
   a. X-ray unit manufacturer
   b. Model number
   c. Serial number
   d. Maximum kVp, mA, Sec
e. Ionizing radiation source/emitter (electron tube)

2. The part of the EXCHANGE contract describing work to be done at the Base 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 Base personnel.

1.9 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 Base personnel.

1.10 USE OF RADIOACTIVE MATERIALS (RAM):

A. Prior to bringing RAM onto Luke Air Force Base property, the Contractor shall obtain permission from the RSO. To obtain approval, forward an application to the RSO, and a courtesy copy to the Contracting Officer at least 30 calendar days before the planned date for commencement of activities on the installation. Requests shall include:

1. A description of the proposed activities on NRC Form 241, Report of Proposed Activities in Non-Agreement States, (the 180-day limitation on the form does not apply to organizations holding an NRC license). Contractors possessing Agreement State Licenses shall also submit an NRC Form 241 to NRC in compliance with 10 CFR 150.21. Contractors requiring more than 180 days of operation per calendar year on the installation shall possess an NRC license.

2. The procedures established to ensure radiological health and safety of Base personnel and the public while on Army or Air Force installations on site and the name of the responsible Contractor representative.
3. A current copy of the applicable NRC, or Agreement State license. Expired licenses are unacceptable. To be valid at the installation, the license must either specifically state the installation by name on the license or state approval for work at temporary job sites anywhere in the United States where the NRC or Agreement State maintains jurisdiction. DOE or DOE prime contractors must provide, in lieu of a license, written certification of their exemption from NRC licensing requirements and cite the applicable exemption of 10 CFR.

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

5. An acknowledgment that the Base RSO may make periodic checks to ensure the Contractor is following applicable radiological health and safety practices which prevent unnecessary exposures to Army or Air Force personnel and prevent potential contamination of Government property.

1.11 USE OF RADIO FREQUENCY (RF) RADIATION

A. Prior to using equipment generating RF Radiation in excess of seven watts peak power and a frequency of 1000 MHz or greater on Luke Air Force Base must submit a written request for approval at least 30 calendar days before commencement of activities which require the use of the RF generating device.

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

1. Description.
2. Nomenclature.
3. Location of emitters.
4. Quantity.
5. Frequency (MHz).
6. Pulse width (microsec.).
7. Pulse repetition freq. (pps).
8. Peak power (kW).
10. Antenna band width (degrees-- horizontal/vertical).
11. Antenna gain (dB).
12. Scan rate (rpm).

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

D. 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 Base personnel.

1.12 USE OF ULTRAVIOLET (UV) RADIATION

A. Submit a written request for approval at least 30 calendar days before commencement of activities which require the use of UV generating devices on Luke Air Force Base.

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

1. The part of the EXCHANGE contract describing work to be done at the base and the inclusive dates of such work.
2. 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 Base personnel.

1.13 PROTECTION OF NESTING BIRDS

A. Federal law prohibits disturbing bird nests containing eggs or birds too young to fly. Harassment of birds to force them to abandon an occupied nest is also illegal. Contractor shall not remove occupied nests or harass protected birds.

B. If an occupied bird nest is discovered, the contractor shall cease activities in the vicinity of the bird nest until the young birds are able to fly and leave the nest under their own power.

C. Cliff swallow nests are usually the greatest threat to construction projects. As a general rule, cliff swallows can begin nest construction any time between 1 February and 31 July.

D. To protect birds under the Migratory Bird Treaty Act, a pre-construction site survey must be performed by a qualified biologist at least 14 calendar days before construction to determine whether any protected species are present on or near the site. If protected birds are present and nesting on or near the site, construction may be temporarily postponed until the nesting season is over. Contact CEIER at least 30 calendar days in advance to arrange the pre-construction site survey. The Contractor shall be responsible for control of new nest construction after issuance of NTP. The contractor shall survey the work area **daily** for new nest construction. To avoid project delays, the contractor shall remove all nests discovered before the nests have been completed and occupied.

E. The contractor shall be responsible for any increased cost or delay resulting from a nest constructed and occupied in the work area after NTP has been issued.

F. Other measures which may be necessary if protected species are found on or near the site during the pre-construction survey include: (1) the contractor may be prohibited from disturbing areas within a specified distance of owl burrows or bird nests; (2) the contractor may be required to shut down or restrict activities during breeding and nesting seasons; (3) construction may be temporarily delayed while birds are encouraged to relocate away from the construction area. The contractor should be advised of these possibilities in contract documents.

1.14 DISCOVERY OF HISTORICAL OR CULTURAL ARTIFACTS

A. Should any historical artifacts or cultural resources be unearthed, stop excavating and immediately notify the Contracting Officer.

1.15 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.

1.16 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.
1.17 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.

1.18 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.

1.19 STORMWATER POLLUTION PREVENTION

A. Prior to clearing, grading or excavating, the Contractor shall obtain a Storm Water Pollution Prevention (SWPP) permit from the State of Arizona Department of Health and a National Pollution Discharge Elimination System (NPDES) permit from the Environmental Protection Agency (EPA). Submit the SWPP Plan to the Contracting Officer for review and approval prior to submitting the plan to NDDOH. Ensure SWPP Plan includes Best management Practices. Additional permits may be required and shall be the responsibility of the Contractor.

B. If contaminated ground water is encountered, the contractor must notify CEV immediately via the Base Environmental 24/7 spill phone (Fire Department) .

1.20 CONTAMINATED SOIL

A. If unexpected contaminated soil is encountered while performing work, stop work immediately and contact the Contracting officer. Do not resume work until approved by the Contracting Officer.
1.21 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.

1.22 OIL-FILLED OR IMPREGNATED ELECTRICAL COMPONENTS

A. Notify 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 Luke Air Force Base Hazardous Material and Waste Handling facility.

1.23 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 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.

1.24 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.
1.25 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 Luke AFB Fire Department 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 Base Fire Department and request they contact ______________________ (Environmental Engineer), ______________________.

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 (CEV or DPW) 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 (CEV or DPW) prior to construction.

1.26 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 ______________________. 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 or Base ______________________ 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 “Luke AFB Waste Disposal” immediately following this Section.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 13 00
LUKE AIR FORCE BASE

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.
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

2. Field engineering and surveying.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
SECTION 01 14 40
EXECUTION REQUIREMENTS

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 NOTIFICATIONS

A. All vehicular movements on site, including but not limited to: material deliveries, trash removal, crane placement of equipment and materials, etc shall be coordinated with the school principal to prevent such activities from occurring when students are outside of their classes or at recess.

B. No overhead equipment or material lifts shall occur over occupied class rooms. Where such activities occur over class egress points, hallways and hallway egress points the contractor shall have safety personnel in place to prevent staff and students from using these areas when lifts are occurring.

C. The general contractor shall be responsible for notifying, in advance, the principal when construction activities that may conflict with normal school operations or that may endanger staff or students are going to occur.

3.3 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.


3.4 CONSTRUCTION LAYOUT
SECTION 01 14 40

EXECUTION REQUIREMENTS

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.5 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

3.6 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet in spaces without a suspended ceiling.

B. Comply with manufacturer’s written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that
SECTION 01 14 40

EXECUTION REQUIREMENTS

adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

  1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.
SECTION 01 14 40

EXECUTION REQUIREMENTS

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION
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 mechanical and 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.

B. Related Requirements:

1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Division 01 Section 01 40 00 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

A. Unit price shall be added to Contractor’s proposal on EXCHANGE Solicitation Form 4450-024, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if concealed conditions cause quantities of Work required by the Contract Documents to be 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 Replacement.

1. Description: Provide interior concrete slab repairs and joint replacement in bid and quantity will be verified in the field.

2. Unit of Measurement: See Unit Price Repair Worksheet.

END OF SECTION
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.

D. Schedule: A Schedule of Options is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each option.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF OPTIONS

A. Option No. 1: Remove existing thin film solar modules and existing single-ply roofing down to the existing protection board and/or down to the existing concrete deck as required per the manufacturer’s recommendations and replace with new rigid insulation, protection board, tapered insulation to match existing and single-ply roof.

B. Option No. 2: Repair the existing HVAC Units No. AHU-1, 2, 4, 5 & 7, replace the existing HVAC Units No. AHU-3 and AHU-6, replace FC-1/CU-1, FC-2/CU-2 split system, add FC-3/CU-3 and FC-4/CU-4 split system, replace HP-1 heat pump, replace HPU-1 heat pump, replace CAC-1 air conditioning, remove the existing evaporator cooler make-up unit, replace VAV
terminal units, replace exhaust fans along with replacing the HVAC controls and balancing air supply, return and exhaust system.

C. Option No. 3: Remove existing fire alarm system in its entirety and replace with fire alarm/mass notification system.

D. Option No. 4: Replace the existing light fixtures with the LED light fixtures including the lighting control cable in the Retail Sales Area, Room No. 3 and Outdoor Living Room No. 113.

E. Option No. 5: Replace the existing HVAC units No. AHU-1, 2, 4, 5 & 7 in its entirety.

F. Option No. 6: Provide demolition, architectural, mechanical, plumbing and electrical associated with the Dental Clinic including Room 41, 50, 51, 52, 53, 54, 55, 56, 56.1, 56.2, 56.3, 56.4, 56.5, 56.6, 56.7, 56.8, 56.9, 56.10 in its entirety.

END OF SECTION 01 23 00
SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

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.

B. Architect's Action: If necessary, Architect will request additional information within seven days of receipt of a request for substitution. Architect will notify Contractor through EXCHANGE Project Manager of acceptance or rejection within 15 Insert number days of receipt, or ten days of receipt of additional information.

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 must be made no less than 10 days prior to proposal closing date, in which case the bidder shall not be liable for costs of the Contracting Officers review, or at any time following award of Contract, in which case, however, the contractor shall be liable for costs of the Contracting Officer's review. 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.

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.

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.

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
SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 REQUESTS FOR INFORMATION (RFIs)
   A. RFI Forms: Software-generated form acceptable to Architect and EXCHANGE Project Manager.
   B. Architect's Action: Allow seven working days for Architect's response for each RFI.
   C. RFI Log: Maintain a tabular log of RFIs. Submit log weekly.

1.2 PROJECT WEB SITE
   A. Use EXCHANGE' Project Web site for project communication and documentation.
   B. EXCHANGE to provide up to seven Project Web site user licenses for use of, EXCHANGE's Commissioning Authority, Contractor, Architect, and Architect's consultants. EXCHANGE to provide eight hours of software training at Architect's office for Project Web site users.
   C. Project Web site software package:
      1. Autodesk, Constructware.

1.3 PRECONSTRUCTION MEETING
   A. The Contracting Officer and/or Contracting Officer's representative will schedule and preside at preconstruction 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.

1.4 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.

1.5 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.

C. Coordination Meetings: At weekly intervals, in addition to specific meetings held for other purposes.

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 of Project
C. Section 01 33 00 - Submittal Procedures

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 submittals which Contractor requires plus two (2) 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 of Project.
B. Section 01 32 00 - Construction Progress Documentation.
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, and if required in the specific section for that material/product, the contractor shall include with the submittal a written certification that the material/product contains no asbestos. This certificate is mandatory, where required by the individual specification sections, and must be submitted 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
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**
   Luke AFB, Arizona

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<th>JAN</th>
<th>FEB</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 (Section 31 10 00). 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 telecopier 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 (31 10 00, 31 15 00, 31 20 00); 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 MATERIALS, SOIL OR GROUNDWATER
Unless otherwise specified elsewhere in this contract, site and building have been inspected and are, 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. The Contractor may encounter undocumented existing building materials including but not limited to lead paint, asbestos or PCB’s. 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 01 35 43
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:

1. Cast-in-Place Concrete: Section 03 30 00.
2. Existing Polished Concrete Floor Finish (AAFES Concrete Finish Consultant): Section 03 35 36.

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. Ascertain 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 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 requirements for temporary utilities, support facilities, and security and protection facilities.
   B. Related Requirements:
       1. Section 01 10 00 "Summary of Project" for work restrictions and limitations on utility interruptions.

1.3 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. 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.
   C. 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.

1.4 INFORMATIONAL SUBMITTALS
   A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
   B. Erosion and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
   D. 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.

E. 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.

1.5 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.

1.6 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. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.

D. 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.

E. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

F. 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.

D. Furnish, install and maintain temporary ADA plus 9 station portable restroom trailer with 6 toilets, 3 urinals, 750 gallon waste tank, water – direct connect, 110v and heat pumps for use by the general public during toilet room renovations. Locate for ease of access by public. Coordinate location with Exchange store manager.

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 01 77 00 "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 of Project."

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. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

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.

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-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.

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

1. Connect temporary service to Owner's existing power source, as directed by Owner.

J. 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.

K. 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.
L. **Electronic Communication Service:** Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. **Processor:** Intel Pentium D or Intel Core Duo, 3.0 GHz processing speed.
2. **Memory:** 4 gigabyte.
3. **Disk Storage:** 300 gigabyte hardisk drive and combination DVD-RW/CD-RW drive.
4. **Display:** 22-inch (560-mm) LCD monitor with 256-Mb dedicated video RAM.
5. **Full-size keyboard and mouse.**
6. **Network Connectivity:** 10/100BaseT Ethernet.
7. **Operating System:** Microsoft Windows XP Professional or Microsoft Windows Vista Business.
8. **Productivity Software:**
   a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
   b. Adobe Reader 7.0 or higher.
   c. WinZip 7.0 or higher.
9. **Printer:** "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
10. **Internet Service:** Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
11. **Internet Security:** Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
12. **Backup:** External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

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 (9 m) 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.

**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. Dewatering Facilities and Drains:** Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

**E. 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.**

**F. Waste Disposal Facilities:** Comply with requirements specified in Section 01 13 00 "Waste Disposal."

**G. Waste Disposal Facilities:** Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

**H. Lifts and Hoists:** Provide facilities necessary for hoisting materials and personnel.

   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

**I. Temporary Elevator Use:** Use of elevators is not permitted.

**J. Temporary Stairs:** Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

**K. Existing Stair Usage:** Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

**L. Temporary Use of Permanent Stairs:** Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

### 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 01 10 00 "Summary of Project."

**C. Temporary Erosion and Sedimentation Control:** Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. 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.

G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations or as indicated on Drawings.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. 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.

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

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

K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
   1. Construct covered walkways using scaffold or shoring framing.
   2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
   3. Paint and maintain appearance of walkway for duration of the Work.

L. 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.
M. 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. Overlay 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.

N. 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 cannot 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. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns.
Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 “Closeout Procedures.”

END OF SECTION 01 50 00
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 50 00 - Temporary Facilities and Controls.

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 50 00 - Temporary Facilities and Controls.

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 cementsations 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.

1.5 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.

1.6 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.

1.7 TELEPHONE SERVICE
A. Provide, maintain, and pay for telephone service to field office at time of project mobilization.
B. Refer to Section 01 50 00 - Temporary Facilities and Controls.

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. Furnish, install and maintain temporary ADA plus 9 station portable restroom trailer with 6 toilets, 3 urinals, 750 gallon waste tank, water – direct connect, 110v and heat pumps for use by the general public during toilet room renovations. Locate for ease of access by public. Coordinate location with Exchange store manager.
D. 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 weather-tight 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 resistive 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.
SECTION 01 58 00
CONSTRUCTION SITE SIGN

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Construction site sign.
   B. Maintenance.
   C. Removal.

1.2 RELATED SECTIONS
   A. Section 01 10 00 - Summary.

1.3 QUALITY ASSURANCE
   A. Design sign and structure to withstand 60 miles/hr (100 km/hr) wind velocity.
   B. Sign Painter: Experienced as a professional sign painter for minimum three years.
   C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.4 SUBMITTALS
   A. Section 01 33 00 - Submittal Procedures: Shop drawings.
   B. Show content, layout, lettering, color, structure, sizes, and grades of members.

PART 2 - PRODUCTS

2.1 SIGN MATERIALS
   A. Structure and Framing: New, wood, structurally adequate.
   B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, 48 inches x 96 inches.
   C. Rough Hardware: Galvanized.
   D. Paint and Primers: Exterior quality, two coats; sign background of color as indicated on the drawing.
   E. Lettering: Exterior quality paint, colors as indicated on the drawing.

2.2 CONSTRUCTION SITE SIGN
   A. One painted project sign of construction, design, and content shown on the next page, location shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install construction site sign within 30 days after Notice to Proceed.
B. Erect at designated location.
C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
D. Install sign surface plumb and level, with butt joints. Anchor securely.
E. Paint exposed surfaces of sign, supports, and framing.

3.2 MAINTENANCE
A. Maintain signs and supports clean, repair deterioration and damage.

3.3 REMOVAL
A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION 01 58 00
Your New
Ft. Bragg Shopping Center

CONTRACTOR’S NAME
Thistown, ST

ARCHITECT’S NAME
Thistown, ST

Another project funded using earnings from your Exchange purchases.

Preferred
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Starting Systems.
B. Demonstration and instructions.
C. Testing, adjusting and balancing.

1.2 RELATED SECTIONS

A. Section 01 40 00 - Quality Requirements: Manufacturers field reports.
B. Section 01 77 00 - Closeout Procedures: System operation and maintenance data and extra materials.
C. Section 23 05 93 - Testing and Balancing: System Commissioning.

1.3 STARTING SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.
B. Notify Contracting Officer seven (7) working days prior to start-up of each item.
C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
E. Verify that wiring and support components for equipment are complete and tested.
F. Execute start-up under supervision of applicable manufacturer's representative and/or Contractors' personnel in accordance with manufacturers' instructions.
G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
H. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.4 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to EXCHANGE and Facility personnel two weeks prior to date of final inspection.
B. Demonstrate project equipment by a qualified representative who is knowledgeable about the project.
C. For equipment of systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with AFFES/Installation personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time at designated location.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

1.5 TESTING, ADJUSTING AND BALANCING

A. Contractor will appoint, employ, and pay for services of an independent firm to perform testing, adjusting, and balancing.

B. The independent firm will perform services specified in Section 23 05 93.

C. Reports will be submitted by the independent firm to the Contracting Officer indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION 01 65 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 debris from roofs, gutters, downspouts, and drainage systems.
   F. Broom clean paved surfaces; rake clean other surfaces of grounds.
   G. Clean all glass.
   H. Replace air conditioning filters if units were operated during construction.
   I. Clean ducts, blowers, and coils, if air H.V.A.C. units were operated without filters during construction.
   J. Maintain cleaning until project, or portion thereof, is occupied by EXCHANGE.

END OF SECTION 01 71 00
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 65 00 - Starting of Systems.
   D. 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. Startup testing completed.
     10. Temporary facilities removed.
     11. Owner advised of heat and utility changeover.
     13. 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 as hard copy in a 3-ring binder Qty 1 CD to Contracting Officer’s representative as draft review copy.

B. Prepare CD label with printed title "Operation and Maintenance Manuals", title of project, and subject matter of CD when multiple CD’s are required.

C. Internally subdivide the CD contents with subfolders, logically organized as described below.

D. Contents: Prepare a Table of Contents for each CD, with each product or system description identified; 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 data as formatted with electronic PDF on three (3) CD’s and three (3) hard copies in a 3-ring binder 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
SUGGESTED INSTRUCTIONS FOR PREPARING DD FORM 1354
(TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY)

1. The page number and the total number of pages comprising each transfer shall be shown in the space provided at the top right-hand part of the form.

2. When two or more pages are required, Items 27 through 29 shall be completed only on the final page. In such cases, the bottom portion of the form shall be torn off of all pages, except the final page, at the line above Items 27 and 28.

ITEM 1 - Self – explanatory

ITEM 2 - Primarily for Navy use, the district number will be assigned by area or district public works office in accordance with coding pattern set forth in NAVEXOS P-1570, par. 3805-7, Item 6. For Army use, enter appropriate Army Engineer district where construction is performed and/or from which the transfer is made. For transfer of construction to the Air Force, enter appropriate Army Engineer district or the district number assigned by area, or Naval district public works office from which the construction transfer is made.

ITEM 4 - For Navy use only, see NAVEXOS P-1570, par. 3805-7, Item 5.

ITEM 5 - Enter date of preparation.

ITEM 6 – For Army use, enter appropriate Army job and directive number. For Air Force use, enter base job number, as appropriate, when form is used for transfer within the Air Force.

ITEM 7 – For Army use, or for transfer of construction to the Air Force, enter separate series of numbers, by fiscal year, for each installation to which real property is transferred; e.g., for FY 1962 show 62-1, 62-2, etc. For Navy use, this serial number will be assigned by respective area or district public works office and will represent the numerical sequence of submissions by respective contract number.

ITEM 8 – Insert appropriate contract number.

ITEM 9 – Self-explanatory.

ITEM 10 – 12: Instructions for Items 2, 3 and 4 apply. (not applicable for Air For Use.)

ITEM 13 – For Navy use only. Insert the accounting number assigned to or used by the activity named in accordance with Item 9. See NAVEXOS P-1570, par. 3805-7, Item 10.

ITEM 14 – For Navy use only. Insert the accounting number assigned to the activity performing the official property accounting for the activity shown in Item 9. See NAVCompt Manual, Vol. 2, Chapter 5, for accounting numbers.

ITEM 15 – Insert an “X” in the appropriate box of block (A) to indicate whether the transfer involves new construction, existing facilities or capital improvements to existing facilities. If the “other” category is used, explain in remarks, Item 31. Additionally, insert an “X” in the appropriate box of block (B) to indicate whether transfer is being made at time of beneficial occupancy, physical completion or financial completion (with respect to new construction). If the “other” category is used, explain in remarks, Item 31.

ITEM 16 – Enter the code number assigned to identify the project with the appropriate construction authorization law.

ITEM 17 – Each single entry will be identified as an item number and this item number will be shown in this column.

ITEM 18 – 19: Category Code and Description. Enter the category code and description (see DoD Instruction 4165.3 (reference (a)) or attachment 1 to enclosure 1 to DoD Instruction 4165.14 (reference (b)) that appropriately describes the primary use for which the facility (buildings, structures, utilities) is designed. Not more than one category code (Item 18) will be listed as a line item (Item 17).
ITEM 20 – Number of Units in terms of buildings or other structures.

ITEM 21 – Type – enter type of construction; i.e., “P” for permanent, “S” for semipermanent or “T” for temporary.

ITEM 22 – Enter the unit of measure abbreviation, such as “SF” for square feet, etc. (see attachment 2 to enclosure 1 to DoD Instruction 4165.14 (reference (b)).

ITEM 23 – Enter total quantity as described in Item 22.

ITEM 24 – Indicate by item number, category code, and description the appropriate cost. In those instances where a document is prepared which lists items carrying costs which, in some cases, may be final and in others may be preliminary, each cost figure by line item will carry an alphabetical suffix of (P) for preliminary or (F) for final.


#First amendment (Ch 1, 7/28/67)
## TRANSFER AND ACCEPTANCE OF MILITARY REAL PROPERTY

<table>
<thead>
<tr>
<th>ITEM NO.</th>
<th>CATEGORY CODE</th>
<th>FACILITY (category description)</th>
<th>NO. OF UNITS</th>
<th>TYPE</th>
<th>UNIT OF MEAS</th>
<th>TOTAL QUANTITY</th>
<th>COST</th>
<th>DRAWING NUMBERS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>18</td>
<td>19</td>
<td>20</td>
<td>21</td>
<td>22</td>
<td>23</td>
<td>24</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

27. STATEMENT OF COMPLETION: The facilities listed hereon are in accordance with maps, drawings, and specifications and change orders approved by the authorized representative of the using agency except for the deficiencies listed on the reverse side.

28. ACCEPTED BY (Signature) DATE

29. PROPERTY VOUCHER NUMBER

**DD FORM** 1 NOV 61 1354 SUPERSEDES ENG FORMS 290 AND 290B AND NAVDOCKS FORM 2317
30. CONSTRUCTION DEFICIENCIES

31. REMARKS

This form has been designed and issued for use in connection with the transfer of military real property between the military departments and to or from other government agencies. It supersedes ENG Forms 290 and 290B (formerly used by the Army and Air Force) and NAVDOCKS Form 2317 (formerly used by the Navy).

Existing instruction issued by the military departments relative to the preparation of the three superseded forms are applicable to this form to the extent that the various items and columns on the superseded forms have been retained. Additional instructions, as appropriate, will be promulgated by the military departments in connection with any new items appearing hereon.

With the issuance of this DD form, it is not intended that the department shall revise and reprint manuals and directives simply to show the number of this DD form. Such action can be accomplished through the normal course of revision for other reasons.
ITEMS FOR DD FORM 1354

CATEGORY CODES: VERIFY FOR ARMY FACILITIES AND AIR FORCE FACILITIES OF THE SAME DESCRIPTION • • • (ABBREVIATION-NOMENCLATURE)

<table>
<thead>
<tr>
<th>CATEGORY CODE</th>
<th>DESCRIPTION</th>
<th>COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. BUILDING SQUARE FOOTAGE:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. RETAIL AREAS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. ADMIN/EMPLOYEE AREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. MPA:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. SERVICES ACTIVITIES:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. FOOD ACTIVITIES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. MALL/PUBLIC TOILETS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. MERCH. EQUIP. RM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. TOTAL BLDG:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. BUILDING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(TOTAL CONTRACT PRICE LESS THE SUM OF THE FOLLOWING)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. HEATING, VENTILATION &amp; AIR CONDITIONING SYSTEM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TONS</td>
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<tr>
<th>CATEGORY CODE</th>
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<tbody>
<tr>
<td>(AR)826-11</td>
<td>OVER 100 TONS</td>
<td>(AC PL OV 110 TN)</td>
</tr>
<tr>
<td>(AF)826123</td>
<td>OVER 100 TONS</td>
<td>(A/C PLT OVET 100 TN)</td>
</tr>
<tr>
<td>(AR)826-12</td>
<td>26-100 TONS</td>
<td>(AC PL-26-100 TN)</td>
</tr>
<tr>
<td>(AF)826122</td>
<td>25-100 TONS</td>
<td>(A/C PLT 25&lt;100 TN)</td>
</tr>
<tr>
<td>(AR)826-13</td>
<td>6-25 TONS</td>
<td>(AC PL 6-25- TN)</td>
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<tr>
<td>(AF)890121</td>
<td>5-25 TONS</td>
<td>(A/C PL 5 TO 25 TN)</td>
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<table>
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<tr>
<td>4. FIRE PROTECTION SYSTEM (FIRE ALARM SYS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUTOMATIC SPRINKLER SYSTEM</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>(AR)880-50</td>
<td>(AUTO SPNLKR SYS)</td>
<td></td>
</tr>
<tr>
<td>(AF)880221</td>
<td>(AUTO FR DTECTN SYS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL:NUMBER OF HEADS</td>
<td></td>
</tr>
<tr>
<td>FOAM FIRE SPRINKLER SYSTEM</td>
<td>$</td>
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</tr>
<tr>
<td>(AR)880-60</td>
<td>(AUTO SPNKLR SYS)</td>
<td></td>
</tr>
<tr>
<td>(AF)980235</td>
<td>(DRY CHEM SYS)</td>
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<tr>
<td></td>
<td>TOTAL:NUMBER OF HEADS</td>
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</tr>
<tr>
<td>FIRE HYDRANTS</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>(AR)843-11</td>
<td>(FR HYDR)</td>
<td></td>
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<tr>
<td>(AF)843315</td>
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<tr>
<td>5. UNDERGROUND ELECTRICAL SYSTEM (INCLUDE. METER)</td>
<td>$</td>
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<tr>
<td>UNGD ELEC DISTR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(AR)812-42</td>
<td>(SEC DISTR LNE UG)</td>
<td></td>
</tr>
<tr>
<td>(AF)890181</td>
<td>(UTIL LNE DUCTS)</td>
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<tr>
<td>TOTAL SERVICE TO BUILDING:</td>
<td>L.F OF</td>
<td>IN. CONDUIT</td>
</tr>
<tr>
<td>AND</td>
<td>CONDUCTOR</td>
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ITEMS FOR DD FORM 1354  
(CONTINUED)

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<th>CATEGORY CODE</th>
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<tr>
<td>6. ELECTRICAL TRANSFORMER</td>
<td>$ ________________</td>
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<tr>
<td>(AR)813-60</td>
<td>(TRANSFORMER)</td>
<td></td>
</tr>
<tr>
<td>(AF)812225</td>
<td>(PRIM DISTR LNE UG)</td>
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<tr>
<td>PAD MOUNTED TRANSFORMER_________ KVA</td>
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<td>7. NATURAL GAS LINE TO BUILDING (INC. METER)</td>
<td>$ ________________</td>
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<tr>
<td>(AR)824-10</td>
<td>(GAS PIPE LIBE)</td>
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<tr>
<td>(AF)824464</td>
<td>(GAS MAINS)</td>
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<td>TOTAL SERVICE TO BUILDING:_________ L.F. OF _______ IN. PIPE</td>
<td></td>
<td></td>
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<tr>
<td>(MATERIAL:_________________)</td>
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<tr>
<td>8. UNDERGROUND TELEPHONE</td>
<td>$ ________________</td>
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<tr>
<td>(AR),....</td>
<td>(UNDG TELEPHONE)</td>
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<tr>
<td>(AF)135583</td>
<td>(TEL DUCT FCLTY)</td>
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<tr>
<td>(AF)890181</td>
<td>(UTIL LNE DUCTS)</td>
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<td>TOTAL SERVICE TO BUILDING: ________ L.F. OF _______ IN. CONDUIT</td>
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<td>9. SANITARY SEWER SYSTEM</td>
<td>$ ________________</td>
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<tr>
<td>(AR)832-10</td>
<td>(SANITARY SEWER)</td>
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<tr>
<td>(AF)932267</td>
<td>(SAN SEWAGE MAIN)</td>
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<td>TOTAL SERVICE TO BUILDING: ________ L.F. OF _______ IN. PIPE</td>
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<tr>
<td>(MATERIAL:_________________)</td>
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<tr>
<td>10. GREASE INTERCEPTOR</td>
<td>$ ________________</td>
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<tr>
<td>(AR)833-90</td>
<td>(LOCAL DESCRIPTION)</td>
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<td>CAPACITY ___________ GALLONS</td>
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<td>11. STORM SEWER SYSTEM</td>
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<tr>
<td>(AR)871-10</td>
<td>(STORM SEWER)</td>
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<tr>
<td>(AF)871183</td>
<td>(STRM DRN DSPL)</td>
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<tr>
<td>TOTAL SERVICE TO BUILDING: ________ L.F. OF _______ IN. PIPE</td>
<td></td>
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<tr>
<td>(MATERIAL:_________________)</td>
<td>TOTAL NUMBER OF DROP INLETS:__________</td>
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<tr>
<td>12. DOMESTIC WATER SYSTEM</td>
<td>$ ________________</td>
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<tr>
<td>(AR)842-10</td>
<td>(WATER PIPE LN P)</td>
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<tr>
<td>(AF)842245</td>
<td>(WTR DISTR MAINS)</td>
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<td>TOTAL SERVICE TO BUILDING: ________ L.F. OF _______ IN. PIPE</td>
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<tr>
<td>(MATERIAL:_________________)</td>
<td>(INCLUDING METER &amp; BACK FLOW PREVENTER)</td>
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<tr>
<td>13. LANDSCAPE IRRIGATION SYSTEM</td>
<td>$ ________________</td>
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<tr>
<td>(AR)871-30</td>
<td>(IRRIGATION FAC)</td>
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<tr>
<td>TOTAL NUMBER OF HEADS___________</td>
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<tr>
<td>14. DUMPSTER ENCLOSURE</td>
<td>$ ________________</td>
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<tr>
<td>(AR)833-12</td>
<td>(REFUSE COLL BLD)</td>
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<tr>
<td>TOTAL AREA:___________ S.F.</td>
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ITEMS FOR DD FORM 1354  (CONTINUED)

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<tr>
<th>CATEGORY CODE</th>
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<tr>
<td>15. PAVING (NON ORGANIZATION VEHICLE PARKING)</td>
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<tr>
<td>(AR)852-15 (NON ORG VEH PRK)</td>
<td>(VEH PKING N/ORGN)</td>
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<tr>
<td>(AF)852262</td>
<td>TOTAL ASPHALT PAVING: S.Y. OF IN. THICK W/ IN. BASE MATERIAL</td>
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<tr>
<td>(AF)852262</td>
<td>TOTAL CONCRETE PAVING: S.Y. OF IN. THICK W/ IN. BASE MATERIAL</td>
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<td>16. CONCRETE WALKS, SLABS &amp; PADS</td>
<td>$ ______________________</td>
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<tr>
<td>(AR)852-20 (SIDEWALK)</td>
<td>(SIDEWALK) PEDESTRIAN TRAFFIC</td>
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<td>(AF)852289</td>
<td>TOTAL AREA: S.F. (EXCLUDING PAVER TILES)</td>
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<td>17. CONCRETE CURBS &amp; GUTTERS</td>
<td>$ ______________________</td>
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<td>(AR)851-10 (ROADS PAVED)</td>
<td>(CURBS &amp; GUTTERS)</td>
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<td>(AF)851143</td>
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<td>18. EXTERIOR SITE LIGHTING (EXT LIGHTING)</td>
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<tr>
<td>(AR)812-30 (EXT LIGHTING)</td>
<td>(EXTERIOR AREA LTG)</td>
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<tr>
<td>(AF)812926</td>
<td>TOTAL NUMBER OF POLES</td>
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<td>19. LANDSCAPING (RELATED LAND IMPROV NB)</td>
<td>$ ______________________</td>
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<td>(AR)871-75 (RELATED LAND INPROV NB)</td>
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<td>20. GASOLINE DISPENSING SYSTEMS</td>
<td>$ ______________________</td>
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<tr>
<td>(AR)411-90 (LOCAL DESCRIPTION)</td>
<td>UNDERGROUND STORAGE TANKS:</td>
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<td>(AR)411-90</td>
<td>NUMBER OF TANKS: SIZE: GALLONS</td>
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<td>(AR)411-90</td>
<td>NUMBER OF DISPENSERS:</td>
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<td>(AR)411-90</td>
<td>NUMBER OF HOSES:</td>
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<td>(AR)411-90</td>
<td>CANOPY SIZE: SF $</td>
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<td>(AR)411-90</td>
<td>KIOSKS: NUMBER SF MGFR COST $</td>
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<tr>
<td>21. CHAIN LINK FENCING (FENCE OR WALLS)</td>
<td>$ ______________________</td>
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<tr>
<td>(AR)872-10 (FENCE OR WALLS)</td>
<td>(FENCE INTERIOR)</td>
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<td>(AF)872248</td>
<td>TOTAL LINEAR FEET: L.F.</td>
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<td>22. TOTAL CONSTRUCTION COSTS:</td>
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</table>
ITEMS FOR DD FORM 1354  (CONTINUED)

ADDITIONAL INFORMATION REQUIRED

MECHANICAL SYSTEMS

H.V.A.C. UNITS

#  MANUFACTURER  MODEL #  CAPACITY  SERIAL #
1.  
2.  
3.  
4.  

EXHAUST FANS

#  MANUFACTURER  MODEL #  CAPACITY  SERIAL #
1.  
2.  
3.  
4.  

SUPPLY FANS

#  MANUFACTURER  MODEL #  CAPACITY  SERIAL #
1.  
2.  
3.  
4.  

CHILLER

BOILER

HEAT PUMP

ROOFTOP A/C UNITS

DOCK LEVELERS

DOCK SHELTERS

ELECTRICAL

DISTRIBUTION PANELS / LIGHT FIXTURES
ITEM NO  MANUFACTURER  MODEL NUMBER  QUANTITY  DESCRIPTION

PLUMBING

#  MANUFACTURER  MODEL #  CAPACITY  SERIAL #
WATER HEATER
WATER CLOSET
WATER CLOSET (H.C.)
URINAL
LAVATORY
LAVATORY (H.C.)
FLOOR SINKS(__#)
FLOOR DRAINS(__#)
MOP SINK
ROOF DRAINS (__#)
ITEMS FOR DD FORM 1354 (CONTINUED)

ADDITIONAL INFORMATION REQUIRED

FIRE PROTECTION SYSTEMS FOR FOOD ACTIVITIES

ANSUL CHEMICAL FIRE SUPPRESSION SYSTEM

TYPE OF SYSTEM:____________

TOTAL NUMBER OF:
  HEADS_________ AUTOMAN RELEASE_________
  REMOTE MANUAL PULL STATIONS___________
  SNAP ACTION ASSEMBLIES__________________
  MECHANICAL GAS SHUTOFF VALVES________'

ITEMS REQUIRED IN CLOSE OUT DOCUMENTS

1. GENERAL CONTRACTOR’S TESTING / TRAINING REPORTS:
   A. TEST AND BALANCE REPORT ON MECHANICAL SYSTEMS
   B. CERTIFICATION OF GROUNDING (RESISTANCE) POWER
   C. INSTRUCTION / TRAINING SESSIONS ON ALL
      MECH/ELEC/EQUIPMENT (INCLUDING PARTICIPANTS’ ROSTER)

2. GENERAL CONTRACTOR’S WARRANTY
3. ROOF(S) WARRANTY
4. ELECTRIC WARRANTY
5. HVAC WARRANTY
6. GREENHOUSE WARRANTY
7. TERMITE PROTECTION GUARANTEE
8. GENERAL CONTRACTOR’S STATEMENT ON “NO ASBESTOS BEARING
   MATERIALS” USED IN CONSTRUCTION
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. Correct grade or alignment of roads, structures and utilities if any changes were made from Contract Drawings.
4. Correct elevations if changes were made in site grading.
5. 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

6. Topography and grades of all drainage.
7. All changes or modifications from the original design.
8. 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 and electronic PDF documents 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>
</table>
1. Include electronic version of the 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 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 01 78 39
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of selected portions of a building.
2. Demolition and removal of selected site elements.
3. Removal of selected interior finishes in areas to be modernized.
4. Patching and repairs.
5. 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.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Summary of Project" 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 22 Sections for cutting, patching, or relocating Plumbing items.
5. Division 23 Sections for cutting, patching, or relocating HVAC items.
6. Division 26 Sections for cutting, patching, or relocating Electrical items.
7. Division 27 Sections for cutting, patching, or relocating Communication 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's on-site operations.
   5. Coordination of EXCHANGE's continuing occupancy of portions of existing building and of EXCHANGE's 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 "Closeout Procedures."
   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's operations will not be disrupted. Provide not less than 72 hours' notice to EXCHANGE of activities that will affect EXCHANGE's 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. Provide secure temporary closure at exterior wall openings where existing infills are removed or new openings created.

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, 22, 23, 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.

E. Remove air-conditioning equipment without releasing refrigerants.

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.

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

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections:

1. Division 03 Section "Architectural Concrete" for general building applications of specially finished formed concrete.
2. Division 03 Section "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.

1.3 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 the Exchange.

C. Shop drawings for reinforcement for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66 (88), "ACI Detailing Manual", showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures. All wall reinforcement must be shown in elevation.

D. Samples of materials as requested by the Exchange, 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 the Exchange. 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.

1.4 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 the Exchange 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

A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide panel with sufficient thickness to withstand pressure of newly-placed concrete without how or deflection.

   1. Use exterior grade plywood complying with U.S. Product Standard PS-1 Medium Density Overlay, Class 1 or better, mill-oiled and edge-sealed.

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. For exposed exterior surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
2. 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 the Exchange.

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. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F or Type G.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. "PSI Super", Cormix.
   c. "Eucon 37", Euclid Chemical Co.
   d. "WRDA 19" or "Daracem", W.R. Grace & Co.
   e. "Rheobuild", Master Builders, Inc.
   g. "Sikament 300", Sika Corp.

H. 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.
I. 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.
   f. “Plastiment”, Sika Corporation.

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 (801-489-5663) 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 the Exchange 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 the Exchange for each proposed mix for each class of concrete at least 15 days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by the Exchange.

D. Design mixes to provide normal weight concrete properties as indicated on the structural drawings and schedules.

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 the Exchange. Laboratory test data for revised mix design and strength results must be submitted to and accepted by the Exchange 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).
C. Use high-range water-reducing admixture (HRWR) in pumped concrete, concrete for industrial slabs, architectural concrete, parking structure slabs, concrete required to be watertight, and concrete with water/cement ratios below 0.50.

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. 5% - 7% as indicated on the drawings.
2. Other concrete (not exposed to freezing, thawing, or hydraulic pressure) or to receive a surface hardener: 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:

2. Portland cement, broom finish, exterior.

2.10 VAPOR RETARDERS
A. Vapor Retarder (for all slab-on-grade applications).

1. Vapor Retarder membrane must have the following qualities:
   a. Minimum Permeance ASTM E-96 0.04 Perms
   b. Water Vapor Retarder ASTM E-1745 Meets or exceeds Class C
   c. Thickness of Retarder (plastic) ACI 302.1R-96 Not less than 10 mils

2. Vapor Retarder:
   b. Griffolyn T-85 by Reef Industries.
   c. Soco-Shield VB-15 by SocoShield.

B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

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 the Exchange.

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 the Exchange.

B. Provide keyways at least 1-1/2 inches deep in construction joints in walls and slabs and between walls and footings. Accepted bulkheads designed for this purpose may be used for slabs.

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 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. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

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 the Exchange.

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.

B. Smooth-Form Finish: For formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, veneer plaster, painting, or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 MONOLITHIC SLAB FINISHES
A. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified:

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of overall minimum Ff 35 – Fl 25 with local minimum Ff 21 – Fl 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply a trowel finish to monolithic slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film-finish coating system.

1. After floating, begin first trowel-finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of Fl 20 – Fl 17. Grind smooth any surface defects that would telegraph through applied floor covering system, including edge curling at joints.

C. For polished interior concrete finish, refer to Section 03 35 10 “Polished Concrete Floor Finish”.

3.11 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.

3. Provide curing and sealing compound to exposed interior slabs and to exterior slabs, walks, and curbs as follows:
   a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen
has disappeared). Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Use membrane curing compounds that will not affect surfaces to be covered with finish materials applied directly to concrete.

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 cumulatively 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 the Exchange.

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.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment. Grout base plates and foundations as indicated using specified non-shrink grout. Use non-metallic grout for exposed conditions.

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 the Exchange.

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.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of the Exchange. 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 of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.

1. Repair finished unformed surfaces that contain defects that affect the concrete’s durability. Surface defects, as such, include crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through nonreinforced sections regardless of width, spalling, popouts, honeycombs, rock pockets, and other objectionable conditions.
2. Correct high areas in unformed surfaces by grinding after concrete has cured at least 14 days.
3. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with patching compound. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to the Exchange.
4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
5. Correct low areas in existing slab by scarifying surface, priming and finishing with patching compound blended into adjacent concrete.

D. 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.

E. Perform structural repairs with prior approval of the Exchange for method and procedure, using specified epoxy adhesive and mortar.

F. Repair methods not specified above may be used, subject to acceptance of the Exchange.

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 the Exchange.

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 the Exchange, 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 the Exchange. 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
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Installation of polished concrete floor system for 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.

1.2 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures.

B. Section 03 35 40 – Interior Concrete Slab Repairs and Joint Filler Replacement.

C. Division 09 – Finishes

1.3 REFERENCES


B. ACI 310 “A Guide to Decorative Concrete”.

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. Polishable overlay product
      f. Grout coat, pin hole and small defect surface treatment
      g. Acrylic Sealer if required

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
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) Budget Maintenance Concrete</td>
<td>610-323-7702</td>
</tr>
<tr>
<td>3) Diama-Shield</td>
<td>888-730-4075</td>
</tr>
<tr>
<td>4) Industrial Restoration &amp; Coatings</td>
<td>801-866-9896</td>
</tr>
<tr>
<td>5) Jeffco Concrete Contractors</td>
<td>800-226-2668</td>
</tr>
<tr>
<td>6) K &amp; J Concrete Polishing</td>
<td>865-971-1760</td>
</tr>
<tr>
<td>7) Pacific Decorative Concrete</td>
<td>888-776-1111</td>
</tr>
<tr>
<td>8) Perfect Polish Inc.</td>
<td>877-917-4463</td>
</tr>
<tr>
<td>9) Preferred Global</td>
<td>800-317-2450</td>
</tr>
<tr>
<td>10) Premier Concrete Construction</td>
<td>603-654-2471</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 at the 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.

5. No work other than the sample may be started prior to approval of the sample area by the AAFES project manager or the owners Polishing Consultant.

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 installed joint treatment in any color for the purpose of judging workmanship. The specific joint color to be used on the project will be selected based on the color of the completed polished concrete sample.

Half of the sample area should include completed stain protection application and half should be without stain protection for testing purposes.

The sample should also include edge finishing treatments for the purpose of review per specifications.

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.

C. Polished Concrete should be sequenced to complete after final lighting is in operation to allow for a proper installation.

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, 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 80ID
2. Pullman-Ermator S36
3. SASE Bull 50
4. Substitutions by Approval Only

C. Diamond Tooling for Coating Removal, Initial Grinding, and Preparing Floor for Polishing: Tooling manufacturer subject to submittal review prior to approval.
   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.

D. Hand Grinder with dust extraction attachment and pads.

E. 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
   4. Substitutions by Approval Only

H. Self-propelled shaver/leveler for slab surface demolition and leveling.
   1. SuperShaver, by CPS
   2. BMC 335 Shaver, by Diamatic
   3. Substitutions by Approval Only

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
   4. Substitutions by Approval Only

2.3 MATERIALS

A. Penetrating Hardener/Densifier: Clear liquid reactive lithium-silicate based.
   1. Retroplate 99 by Advanced Floor Products.
   3. FGS Permashine by L&M Construction Chemicals.
   4. 3DHS Densifier by AmeriPolish
   5. Substitutions by Approval Only

B. Protective Surface Treatment (Stain Guard):
   1. Retro Guard by Advanced Floor Products
   2. Consolideck LS Guard, by Prosoco.
   3. FGS Stain Protection by L&M Construction Chemicals.
   4. SR2 Stain Protector by AmeriPolish.
   5. Substitutions by Approval Only

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 color to match Polished Concrete, by VersaFlex Inc.
2. RS65 Polyurea in complementary color to match Polished Concrete, by Metzger McGuire
3. HT-PE65 Polyurea in complementary color to match 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. Substitutions be Approval Only
4. Colors to be reviewed and approved by AAFES Project Manager or Polished Concrete Consultant in mock-up.

F. Wide Area Surface Repairs
1. UltraTop PC by Mapei
2. Color of the overlay after application of Specified Dye to be reviewed and approved by AAFES Project Manager or owners Polished Concrete Consultant in mock-up.

G. Pin Hole and Surface Pitting Grout Coat
1. GM 3000, by Husqvarna Construction Products
2. Versa-Grout, by VersaFlex
3. Spall TX3 by Hi-Tech
4. Approved Equal
5. Color after application to be reviewed and approved by AAFES Project Manager or Polished Concrete Consultant in mock-up.

H. Acrylic Sealer
1. CSS Emulsion (25% solids) by Elite Crete
2. H&C Clear Solvent Based Acrylic (25% solids) by Sherwin Williams
3. Approved Equal

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.

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. Completely remove existing flooring, mastics, adhesives, self-leveling underlayment fillers and
other foreign matter.

C. Remove the top \( \frac{1}{2} \) 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 07 90 00.

F. Repair all slab defects and joints in accordance with Section 03 35 40

G. For areas to be prepped and sealed per plans perform one 40 grit grind to remove all glue, mastic or underlayment’s on the surface. Clean the surface well prior to installation of sealer.

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. Progressive edge grinding will be necessary with \( \frac{1}{2} \)” of all vertical abutments, including walls, cases, columns, posts and racking systems.
      d. 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 at the recommended step 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 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.

7. Clean & Seal:
   In areas designated per plans to be clean and seal only, remove all surface glue, mastics and any underlayment’s. Fill joints and then seal the floor using two coats of an acrylic solvent based sealer with 25% solids. Insure that there are no roller marks are patterns in the sealer placement. Contact the architect or the owners consultant if you have any additional questions.

D. Penetrating Dye
   1. Mix dye in accordance with manufacturer’s instructions for use in blending and matching patches.

E. Exchange Logo
   1. Where indicated on drawings install a dyed Exchange logo. Colors are to be as follows
      a. Blue area is to be AmeriPolish Classic Patriot Blue
      b. Red 1 is to be AmeriPolish Classic Sepia
      c. Red 2 is to be sprayed with two colors. First is a 20% strength AmeriPolish Classic Black. The second color is to be 100% strength AmeriPolish Classic Sepia.
   2. The logo is to be laid out using a stencil to allow for color change without the use of decorative score lines.
      a. Approved stencil manufacturer is FloorMap Stencil Design.
   3. All color transitions are to be installed with clean lines and no bleed.

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 03 35 36
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.
   2. Spalled joint repair or joint with metal keyway (less than 3/4”)
   3. Spalled joint repair, joint with metal keyway or self-leveling compound removal (great than 3/4”)
   5. Surface defect repair, including pop-outs, spalls, and gouges.
   6. Surface embed repair, including cleanouts, in-floor electrical outlets and Walker Duct access holes.
   7. Large area surface repair, existing underlayment removal/replacement and delamination repair.
   8. Grout coat surface enhancement, including air voids, micro-pin holes, pitting and other shallow surface deficiencies.
   9. Full Grind, Densify and Polish portions of the project not currently indicated on the drawings.
   10. Unit Price Repair Worksheet for estimating and bidding purposes. All prospective bidders must include a completed worksheet included at the end of this specification as part of their bid package. Any bid provided without a completed worksheet may be subject to rejection.

1.2 SUBMITTALS

A. Section 01 33 00 - 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: All products 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 21 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 color to match Polished Concrete, by VersaFlex Incorporated
   2. RS65 Polyurea in complementary color to match Polished Concrete, by Metzger/McGuire.
   3. HT-PE65 Polyurea in complementary color to match Polished Concrete, by Hi-Tech Systems
   4. Colors to be reviewed and approved by AAFES Project Manager or owners Concrete 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. Colors to be reviewed and approved by AAFES Project Manager or owners Concrete Consultant in mock-up.

D. Wide Area Surface Repairs
   1. UltraTop PC by Mapei
   2. No Substitutions
   3. Color after installation to be reviewed and approved by AAFES Project Manager or owners Concrete Consultant in mock-up.

E. Pin Hole and Surface Pitting Grout Coat
   1. GM 3000, by Husqvarna Construction Products
   2. Spall TX3 by Hi-Tech
   3. Versa-Grout, by VersaFlex
   4. Pit-Grout by Metzger McGuire
   5. Color after application to be reviewed and approved by AAFES Project Manager or owners Concrete Consultant 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. 80ID, by HTC.
      b. S36, 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. Surface Grinder: Handheld 4"-7" electric surface grinder with dustless shroud/housing.
1. Dust Avenger by Joe Due.
2. SawTec Grinder Vac, by U.S. Saws.
3. 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 owners 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 1/2” 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 out gassing.
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 > 1/2” in thickness or surface paste delaminations.

1. Define edge perimeter with diamond masonry wheel or shaver/leveler to produce sharp edge, at least 1/2” 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 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.

B. For large areas over 50 square feet with existing fill where the depth after removal is greater than 1”, the following manufacturer approved process shall be used in conjunction with #16-20 dry sand to fill depressions to 1/2” below final floor level. The standard mix and installation shall occur above this sub-base fill.

1. Mix the cementous overlay topping according to the technical data sheet. The drill should be equipped with a box style paddle, and should run at a minimum speed of 800-1200 RPM. The material shall be mixed for a minimum time of 3 – 3.5 minutes. The sand fill may be added up to 30% by volume or 25 pounds per bag maximum.
2. Sands may be pre-wetted to reduce the water demand.
3. Be sure that a calibrated container is used for measuring the mix water. Using 4.5 to 5.0 quarts. The water amount will vary based on the amount of sand added.
4. Using a screed or rake spread the material over the primed surface. Be sure to fill any holes or low areas in the surface during the installation. This material after mixed will not exhibit self-leveling properties. The material may be smoothed using a standard overlay stainless smoothing tool or trowel.
5. Any smoothing or finishing should be done within 15 minutes of the application. After 20 minutes the surface should not be touched.
6. Allow the material to dry for a minimum of 24 hours before installing the second primer application. The Sub Base fill layer must be primed before the application of the overlay system. Refer to the manufacturer polishing specification for installation details.
7. Large Batch Mixing: For large batch mixing, place the measured amount of water in the mixer for all of the bags first. Hold back a small amount of the water to add during mixing. Add all of the bags to the mixer and the sand with the mixer running. Add the retained water during mixing. The material should mix for 6-7 minutes until a smooth and even consistency has been reached. Discharge the hopper directly into the pump for placement.
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 approved product 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
<table>
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<th>ITEM</th>
<th>AREA FROM ABOVE</th>
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<th>TOTAL FROM MULTIPLIER</th>
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<td>6. Surface embed repair, including cleanouts, in-floor electrical outlets and Walker Duct access holes.</td>
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<td>7. Large surface repair, existing underlayment removal and replacement wit 1/4&quot; Polished Overlay.</td>
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<td>8. Grout coat surface enhancement, including micro-pin holes, pitting and other shallow surface deficiencies</td>
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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Steel framing and supports for doors.
   2. Steel framing and supports for mechanical and electrical equipment.
   3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   4. Loose bearing and leveling plates.
   5. Miscellaneous steel trim.

B. Products furnished, but not this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts and steel pipe sleeves to be cast into concrete or built into unit masonry.

C. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
   2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
   3. Division 5 Section "Structural Steel."

1.3 PERFORMANCE REQUIREMENTS
A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.4 SUBMITTALS
A. Shop Drawings: Show fabrication and installation details for metal fabrications.
SECTION 05 50 00

METAL FABRICATIONS

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
2.3 FERROUS METALS

A. W-Shapes: ASTM A 992.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500, Grade B, structural.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

E. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.
   1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
   2. Material: Steel complying with ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230) 0.0677-inch (1.7-mm) minimum thickness.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).

D. Anchor Bolts: ASTM F 1554, Grade 36.
   1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.


SECTION 05 50 00

METAL FABRICATIONS

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.


2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 painting Sections.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products:
   b. Carboline Company; Carbozinc 621.
   c. ICI Devoe Coatings; Catha-Coat 313.
   f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.


E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
SECTION 05 50 00

METAL FABRICATIONS

G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
   1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS
SECTION 05 50 00

METAL FABRICATIONS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings at locations indicated. Weld adjoining members together as indicated on project plans.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

   1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Prime exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated with zinc-rich primer.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES
SECTION 05 50 00
METAL FABRICATIONS

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

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. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
SECTION 05 50 00

METAL FABRICATIONS

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

   1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.

   2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

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

END OF SECTION 05 55 00
SECTION 06 10 0
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Framing with dimensional lumber.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimensional Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. WCLIB: West Coast Lumber Inspection Bureau.
   2. WWPA: Western Wood Products Association.

1.4 SUBMITTALS

A. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
   1. Wood-preservative-treated wood.
   2. Expansion anchors.
   3. Metal framing anchors.

B. The Engineered Wood Products manufacturer and installer shall each provide written certification to the Architect that the Engineered Wood Products have been installed and constructed in conformance with the Engineered Wood plans and specifications.

1.5 QUALITY ASSURANCE

A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA C2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood floor plates that are installed over concrete slabs-on-grade.
2.3 DIMENSION LUMBER FRAMING

A. Maximum Moisture Content: 19 percent.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

   1. Blocking.
   2. Nailers.

B. For items of dimension lumber size, provide No. 2 grade lumber with 19 percent maximum moisture content and the following species:

   1. Douglas Fir-Larch; WCLIB or WWPA.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.


D. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

E. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.6 METAL FRAMING ANCHORS

A. Basis-of-Design Products: Subject to compliance with requirements, provide Simpson Strong-Tie Co. or comparable products. Alternate metal framing anchors may be proposed provided they have equal or better design capacities. It shall be the responsibility of the alternate metal framing anchor company to provide written documentation indicating the better design capacities. Comparable products are one of the following:

   1. Alpine Engineered Products, Inc.
   2. KC Metals Products, Inc.
   3. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer that meet or exceed those of Simpson Strong-Tie Co. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA’s "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer’s written instructions.

D. Metal Framing Anchors: Install metal framing to comply with manufacturer’s written instructions.

E. Do not splice structural members between supports, unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC’s International Building Code.

K. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
SECTION 06 10 0

ROUGH CARPENTRY

3.2 WOOD GROUND, BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-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. Remove temporary grounds when no longer required.

END OF SECTION 06 10 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Wood cabinets.
2. Plastic-laminate countertops.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, including cabinet hardware and accessories and finishing materials and processes.

1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Thermoset decorative panels.

D. Samples for Verification:

1. Lumber with or for transparent finish, not less than 5 inches (125 mm) wide by 24 inches (600 mm) long, for each species and cut, finished on 1 side and 1 edge.
SECTION 06 40 00

ARCHITECTURAL WOODWORK

2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
3. Veneer-faced panel products with or for transparent finish, 12 by 24 inches (300 by 600 mm), for each species and cut. Include at least one face-veneer seam and finish as specified.
4. Lumber and panel products with shop-applied opaque finish, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels, for each finish system and color, with 1/2 of exposed surface finished.
5. Thermoset decorative panels, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with edge banding on 1 edge.
6. Solid-surfacing, 4 inches square.
7. Corner pieces as follows:
   a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches (450 mm) high by 18 inches (450 mm) wide by 6 inches (150 mm) deep.
8. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.

C. Quality Standard: Perform work to premium quality for construction, finishes, installation, and other requirements in accordance with "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute (AWI), 2310 S. Walter Reed Drive, Arlington, Virginia 22206-1199.

   1. Provide AWI Quality Certification Program labels and certificates indicating that for woodwork, including installation, complies with requirements of grades specified.

D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

E. Forest Certification: Provide interior architectural woodwork produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

   1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
SECTION 06 40 00
ARCHITECTURAL WOODWORK

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Species and Cut for Transparent Finish: White birch, rift sawn or cut.

C. Wood Products: Comply with the following:

1. Hardboard: AHA a135.4
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD.
3. High Density Fiberboard (HDF).
5. Softwood Plywood: DOC PS 1, Medium Density Overlay.
6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA Grade AA.
7. Cores:
SECTION 06 40 00

ARCHITECTURAL WOODWORK

a. All sides, tops, countertops, bottoms, doors, drawer fronts, and partitions shall have minimum 3/4" thick multi-core premium grade panel product cores manufactured for use as a core material for laminated casework. Provide 1-inch thickness for bottom panel of wall hung units (same as shelves).

b. All wet area countertop (kitchen, restrooms, toilet rooms or as noted on plans) core materials shall have a minimum of 3/4" thick premium grade marine plywood with fully waterproof structural adhesives.

c. Shelf Cores: Shelves shall have the same core material as specified for the cabinet body except provide 1-inch thickness.

d. Multi-Core Panel Products: Simpson Plyron, Simpson or equal.

D. Highly-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.

1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.

3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:


2. Interior Type A: Low-hygroscopic formulation.

3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.

4. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.

5. Kiln-dry materials before and after treatment to levels required for untreated materials.

2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware (Scheduled by Naming Products) or Door Hardware (Scheduled by Describing Products)."

B. Butt Hinges: 2-3/4-inch, 5-knuckle steel hinges made from 0.095-inch thick metal, and as follows:
1. Semiconcealed Hinges for Flush Doors: BHMA A156.9, B01361.
2. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100, 135, or 170 degrees of opening as required per application, self-closing.

D. Back-Mounted Pulls: BHMA A156.9, B02011.

E. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter.

F. Catches: As required for Heavy Duty application: Magnetic catches, BHMA A156.9, B03141, Push-in magnetic catches, BHMA A156.9, B03131, Roller catches, BHMA A156.9, B03071, Ball friction catches, BHMA A156.9, B03013.

G. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.

H. Shelf Rests: BHMA A156.9, B04013; metal.

I. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type, 200 lb min. capacity; zinc-plated steel ball-bearing slides at pantry and dorm lockers.
2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
4. Pencil Drawer Slides: Grade 1; for drawers not more than 3 inches high and 24 inches wide.
5. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 inches high and 16 inches wide.

J. Door Locks: BHMA A156.11, E07121.

K. Drawer Locks: BHMA A156.11, E07041.

L. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.

1. Product: Subject to compliance with requirements, provide "OG or SG series" by Doug Mockett & Company, Inc. or equal.

M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.
SECTION 06 40 00
ARCHITECTURAL WOODWORK

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
   2. Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).
   3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

   1. Seal edges of openings in countertops with a coat of varnish.

2.6 WOOD CABINETS FOR TRANSPARENT FINISH

A. Grade: Premium.

B. AWI Type of Cabinet Construction: Reveal overlay.
SECTION 06 40 00

ARCHITECTURAL WOODWORK

C. WI Construction Style: Style B, Face Frame.

D. WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

E. WI Door and Drawer Front Style: Reveal overlay.

F. Reveal Dimension: 3/4 inch.

G. Wood Species and Cut for Exposed Surfaces: White birch, plain sawn or sliced.

   1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
   5. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
   6. Comply with veneer and other matching requirements indicated for blueprint-matched paneling.
   7. Edge treatment: 3mm PVC T-Mold, color to be selected by Architect.

H. Semiexposed Surfaces: Provide surface materials indicated below:

   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
   2. Drawer Sides and Backs: Thermoset decorative panels.
   3. Drawer Bottoms: Thermoset decorative panels.

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

2.7 Plastic-Laminate Countertops:

   1. High-Pressure Decorative Laminate Grade: HGS.
   2. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range of patterns, matte finish.
   3. Edge Treatment: Edge with 3mm PVC T-Mold, color to be selected by Architect.

2.8 SHOP FINISHING

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 9 painting Sections for finishing opaque-finished architectural woodwork.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

   1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain
SECTION 06 40 00

ARCHITECTURAL WOODWORK

surfaces. Concealed surfaces of woodwork do not require backpriming when surfaced with high-pressure decorative laminate.

D. Transparent Finish:

1. AWI Finish System: Catalyzed Vinyl.
2. Staining: To be selected.
3. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
5. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.

   a. Apply wash-coat sealer after staining and before filling.

6. Sheen: Satin, 40-60 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork. Fire-treated wood shall be installed in telephone, IT or data rooms or as indicated on plans.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
G. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Maintain veneer sequence matching of cabinets with transparent finish.
3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips and No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

H. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer’s written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c and to walls with adhesive.
4. Provide sealant at space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.
SECTION 06 60 00
SOLID SURFACING COUNTERTOPS

PART 1  GENERAL

1.01  SUMMARY

A. Work described in this section:
   1. Countertops with sinks.

B. Related work specified elsewhere:
   1. Custom casework.
   2. Plumbing.

1.02  REFERENCES

A. Applicable Standards: Standards of the following, as referenced herein:
   1. American National Standards Institute (ANSI)
   3. National Electrical Manufacturers Association (NEMA)
   4. Federal Specifications (FS)

1.03  SUBMITTALS

A. Shop drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

B. Samples: Submit minimum 2" x 2" (50 mm x 50 mm) samples. Indicate full range of color and pattern variation. Approved samples will be retained as standard for work.

C. Product data: Indicate product description, fabrication information and compliance with specified performance requirements.

D. Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

E. Product Data for Credit EQ 4.1: For installation adhesives and sealants, including printed statement of VOC content.

F. Product Data for Credit(s) MR 4.1 and MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content. Include statement indicating costs for each product having recycled content.

1.04  QUALITY ASSURANCE

A. Allowable tolerances:
   1. Variation in component size: ± 1/8" (3mm).

   2. Location of openings: ± 1/8" (3mm) from indicated location.
SECTION 06 60 00

SOLID SURFACING COUNTERTOPS

1.05 DELIVERY, STORAGE AND HANDLING
A. Deliver no components to project site until areas are ready for installation. Store components indoors prior to installation.
B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.06 WARRANTY
A. Provide manufacturer's 10 year warranty against defects in materials. Warranty shall provide material and labor to repair or replace defective materials. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 PRODUCTS

2.01 SOLID POLYMER FABRICATIONS
A. Specified product: Corian Surfaces from The DuPont Company
B. Material: Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 & .6, Type Six, and Fed. Spec. WW-P-541E/GEN.
   1. Material shall have minimum physical and performance properties specified in the following Section U.
   2. Superficial damage to a depth of 0.010" (.25mm) shall be repairable by sanding and polishing.
C. Countertops with sinks: 1/2" thick countertops of Corian; edge details as indicated on the Architect's Drawings, complete with double bowl sink.

2.02 ACCESSORY PRODUCTS
A. Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
   1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
B. Sealant: Manufacturer's standard mildew-resistant, FDA/UL recognized silicone sealant in color matching or clear formulations.
   1. VOC Content: 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.03 FABRICATION
A. Fabrications to be performed by a Certified CORIAN fabricator/installer.
B. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and DuPont requirements.
SECTION 06 60 00

SOLID SURFACING COUNTERTOPS

C. Form joints between components using manufacturer’s standard joint adhesive. Joints shall be inconspicuous in appearance and without voids. Attach 2” wide reinforcing strip of CORIAN under each joint.

D. Provide holes and cutouts for plumbing and bath accessories as indicated on the drawings.

E. Rout and finish component edges to a smooth, uniform finish. Rout all cutouts, then sand all edges smooth. Repair or reject defective or inaccurate work.

F. Finish: All surfaces shall have uniform finish.
   1. Matte, with a gloss rating of 5-20.

PART 3 EXECUTION

3.01 JOB MOCK-UP

A. Prior to final approval of shop drawings, erect one full size mock-up of each component at project site for Architect review.

B. Should mock-up not be approved, rework or remake until approval is secured. Remove rejected units from project site.

C. Approved mock-ups shall remain as part of finished work.

3.02 INSTALLATION

A. Install components plumb and level, in accordance with approved shop drawings and product installation details.

B. Form field joints using manufacturer’s recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

C. Adhere undermount/submount/bevel mount sinks/bowls to countertops using manufacturer’s recommended adhesive and mounting hardware.

D. Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and color-matched silicone sealant.

E. Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops using manufacturer’s standard color-matched silicone sealant.

F. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

G. Make plumbing connections to sinks in accordance with Division 15. Mechanical.

H. Protect surfaces from damage until Date of Substantial Completion. Repair or replace damaged work that cannot be repaired to Architect’s satisfaction and invoice for the cost of repairs. Architect to pre-approve cost estimate before repairs are made.

I. Fabricator/Installer is to provide the CORIAN Commerical Care and Maintenance video, review maintenance procedures and the DuPont warranty with the head of maintenance upon completion of project.

END OF SECTION 06 60 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Mechanically fastened membrane roofing system.
   2. Roof insulation.
   3. Walkway pads.

B. Related Sections include the following:
   1. Division 6 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Division 7 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.
   3. Division 7 Section "Expansion Control".

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

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

1.5 SUBMITTALS
SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.

C. Samples for Verification: For the following products:
   1. 12-by-12-inch (300-by-300-mm) square of sheet roofing, of color specified, including T-shaped side and end lap seam.
   2. 12-by-12-inch (300-by-300-mm) square of roof insulation.
   3. 12-by-12-inch (300-by-300-mm) square of walkway pads or rolls.
   4. 12-inch (300-mm) length of metal termination bars.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in “Performance Requirements” Article.
   1. Submit evidence of meeting performance requirements.

F. Qualification Data: For Installer and manufacturer.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of roofing system.

H. Research/Evaluation Reports: For components of membrane roofing system.

I. Maintenance Data: For roofing system to include in maintenance manuals.

J. Warranties: Special warranties specified in this Section.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that has FMG approval for membrane roofing system identical to that used for this Project.

B. Source Limitations: Obtain components for membrane roofing system from or approved by roofing membrane manufacturer.

C. Fire-Test-Response Characteristics: Provide membrane roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
1. **Fire-Resistance Ratings:** ASTM E 119, for fire-resistance-rated roof assemblies of which roofing system is a part.

1.7 **DELIVERY, STORAGE, AND HANDLING**

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 **PROJECT CONDITIONS**

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 **WARRANTY**

A. Special Warranty: Manufacturer's standard form, with no dollar limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks.

1. Special warranty includes roofing membrane, base flashings, roof insulation, fasteners, walkway products and other components of membrane roofing system.

2. Warranty Period: 20 years from date of Substantial Completion.

**PART 2 - PRODUCTS**

2.1 **MANUFACTURERS**

A. Manufacturers: Basis of this Specifications is Firestone Ultraply TPO subject to compliance with requirements, products from the following will be considered:

1. Genflex.

2. Carlisle SynTec Incorporated.
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

3. Firestone Building Products Company.
4. GAF.
5. Versico "Veriweld".

2.2 THERMOPLASTIC POLYOLEFIN ROOFING MEMBRANE

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: Uniform, flexible sheet formed from a thermoplastic polyolefin, internally fabric or scrim reinforced, and as follows:

1. Thickness: 60 mils (1.5 mm), nominal.
2. Exposed Face Color: White.
3. Physical Properties:
   a. Breaking Strength: 225 lbf (1 kN); ASTM D 751, grab method.
   b. Elongation at Break: 15 percent; ASTM D 751.
   c. Tearing Strength: 55 lbf (245 N) minimum; ASTM D 751, Procedure B.
   d. Brittleness Point: Minus 40 deg F (minus 40 deg C) ASTM D2137.
   e. Ozone Resistance: No cracks after sample, wrapped around a 3-inch- (75-mm-) diameter mandrel, is exposed for 166 hours to a temperature of 104 deg F (40 deg C) and an ozone level of 100 ppm (100 mPa); ASTM D 1149.
   f. Resistance to Heat Aging: 90 percent minimum retention of breaking strength, elongation at break, and tearing strength after 166 hours at 240 deg F (116 deg C); ASTM D 573.
   g. Water Absorption: Less than 4 percent mass change after 166 hours' immersion at 158 deg F (70 deg C); ASTM D 471.
   h. Linear Dimension Change: Plus or minus 2 percent; ASTM D 1204.

4. Manufacturing shall provide a ½" protection board.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard thermoplastic polyolefin sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive.

1. Adhesive appropriate for bonding one layer of insulation to another.

D. Metal Termination Bars: Manufacturer's standard predrilled bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

E. Metal Battens: Manufacturer's standard, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, prepunched.
SECTION 07 54 23

THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

F. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate and acceptable to membrane roofing system manufacturer.

2.4 ROOF INSULATION

A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated. Average R-values of 30 on roof.

B. Polyisocyanurate Board Insulation: (First Layer) ASTM C 1289, Type II, felt or glass-fiber mat facer on both major surfaces.
   1. Medium Density: 20 lb./cu. ft.
   2. Average R-Values of 30 on roof plan. Tapered insulation can be used in the calculations for the overall average R-38 value.
   3. Thickness: 2-1/2" layers – 5" overall minimum thickness.
   4. Average R-Values of 30 on roof plan. Tapered insulation can be used in the calculations for the overall average R-30 value.

C. Insulation must be manufactured within 500 miles of project site.

2.5 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 5 Section "Steel Deck."
   4. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install two or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches (50 mm) or greater, install 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FMG's “Approval Guide” for specified Windstorm Resistance Classification.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.
SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

B. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

D. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

E. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

F. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer’s written instructions to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
   2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer’s written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with sheet flashing.

D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer’s technical personnel to inspect roofing installation on completion and submit report to Architect.
   1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
SECTION 07 54 23
THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 07 54 23
SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. Labor and materials necessary to furnish and install flashing, sheet metal work and related appurtenances as detailed on drawings and/or as required to provide complete flashing system.

1.02 SUBMITTALS

A. Product Data, Flashing, Sheet Metal, Accessories: Submit manufacturer's product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

B. Shop Drawings, Flashing, Sheet Metal, Accessories: Submit shop drawings showing layout, joining, profiles, and anchorages of fabricated work, including major counter-flashings, trim units and expansion joint systems; layouts at 1/4" scale, details at 3" scale.

1.03 JOB CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of the work and protection of materials and finishes.

PART 2 PRODUCTS

2.01 FLASHING AND SHEET METAL MATERIALS

A. Sheet Metal Flashing/Trim:

1. Zinc-Coated Steel: Commercial quality with 0.20% copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, mill phosphatized where required for painting; 0.0359" thick (20 gauge).

B. Miscellaneous Materials and Accessories:

1. Solder: For use with steel, provide 50-50 tin/lead solder (ASTM B 32), with rosin flux.
   a. Limit lead content of solder or flux to 0.2%.

2. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

3. Bituminous Coating: FS TT-C-494 or SSPC - Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

4. Mastic Sealant: Polyisobutylene; non-hardening, non-skinning, non-drying, non-migrating sealant.
SECTION 07 62 00

FLASHING AND SHEET METAL

5. Elastomeric Sealant: Generic type recommended by manufacturer of metal and fabricator of components being sealed; comply with FS TT-S-0027, TT-S-00230, or TT-S-001543.

6. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet.

7. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

C. Roofing Cement: ASTM D 2822, asphaltic.

2.02 COPING

A. Acceptable Manufacturers:

1. Metal-ERA.

2. MM Systems Corporation.

B. Perma-Tite: 24 gauge, Kynar Finish, snap-on, no exposed fasteners with factory fabricated welded accessories.

C. Color as indicated on drawings.

2.03 FABRICATED UNITS

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of the work. Form work to fit substrates. Comply with material manufacturer’s instructions and recommendations for forming material. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels required, with exposed edges folded back to form hems.

B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. Thin edges to be seamed, form seams, and solder.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1” deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where moveable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
PART 3 EXECUTION

3.01 INSTALLATION REQUIREMENTS

A. General: Comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods required, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as required. Install work with laps, joints and seams which will be permanently watertight and weatherproof.

B. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

3.02 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

B. Protection: Protect flashings and sheet metal work during construction, to ensure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

END OF SECTION 07 62 00
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes firestopping for the following:

1. Penetrations through fire-resistance-rated walls and partitions including both empty
   openings and openings containing cables, pipes, ducts, conduits, and other penetrating
   items.

2. Penetrations through smoke barriers and construction enclosing compartmentalized
   areas involving both empty openings and openings containing penetrating items.


B. Related Sections: The following Sections contain requirements that relate to this
   Section:

1. Division 4 Section "Unit Masonry" for joint fillers for non-fire-resistive-rated masonry
   construction.

2. Division 7 Section "Building Insulation" for safing insulation and accessories.

3. Division 7 Section "Joint Sealants" for non-fire-resistive-rated joint sealants.

4. Division 15 Sections specifying ducts and piping penetrations.

5. Division 16 Sections specifying cable and conduit penetrations.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems that are produced and installed to resist the spread of
   fire, according to requirements indicated, and the passage of smoke and other gases.

B. F-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems
   with F ratings indicated, as determined per ASTM E 814, but not less than that equaling or
   exceeding the fire-resistance rating of the constructions penetrated.

C. T-Rated Through-Penetration Firestop Systems: Provide through-penetration firestop systems
   with T ratings, in addition to F ratings, as determined per ASTM E 814, where indicated and
   where systems protect penetrating items exposed to contact with adjacent materials in
   occupiable floor areas. T-rated assemblies are required where the following conditions exist:

1. Where firestop systems protect penetrations located in construction containing doors
   required to have a temperature-rise rating.

2. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal
   pipe or 16 sq. in. in overall cross-sectional area.

D. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as
   determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance
   rating of the construction in which the joint occurs.
E. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

F. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined per ASTM E 84.

1.04 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of product specified.

1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.

C. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.

2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.

D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

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, names of Architects and Owners, and other information specified.
1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the “System Performance Requirements” article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water is maintained at a distance of 0.78 inch below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their “Fire Resistance Directory,” by Warnock Hersey, or by another qualified testing and inspecting agency.

3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water, as measured 0.78 inch from the face exposed to furnace fire. Provide systems complying with the following requirements:
   a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their “Fire Resistance Directory” or by another qualified testing and inspecting agency.
   b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

B. Information on drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.

C. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer’s products per specified requirements. A manufacturer’s willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

D. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
SECTION 07 84 00

FIRESTOPPING

E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."

F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

1.08 SEQUENCING AND SCHEDULING

A. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

PART 2 - PRODUCTS

2.01 FIRESTOPPING, GENERAL

A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.

B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:

1. Permanent forming/damming/backing materials including the following:
   a. Semirefractory fiber (mineral wool) insulation.
   b. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated formboard.
   d. Joint fillers for joint sealants.
SECTION 07 84 00

FIRESTOPPING

2. Temporary forming materials.
5. Steel sleeves.

C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.02 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer’s mastic coating.

B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.


E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.

G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.

I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.

K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
   1. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
   2. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.

L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
   1. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
SECTION 07 84 00
FIRESTOPPING

2. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.

M. Products: Subject to compliance with requirements, provide one of the following:

1. Ceramic-Fiber and Mastic Coating:
   a. FireMaster Bulk and FireMaster Mastic, Thermal Ceramics.

2. Ceramic-Fiber Sealant:

3. Endothermic, Latex Sealant:
   a. Fyre-Shield, Tremco Inc.

4. Endothermic, Latex Compounds:

5. Intumescent Latex Sealant:

6. Intumescent Putty:
   a. Pensil 500 Intumescent Putty, General Electric Co.
   b. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
   c. Fire Barrier Moldable Putty, 3M Fire Protection Products.

7. Intumescent Wrap Strips:
   a. Dow Corning Fire Stop Intumescent Wrap Strip 2002, Dow Corning Corp.
   b. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.

8. Job-Mixed Vinyl Compound:
   a. USG Firecode Compound, United States Gypsum Co.

9. Mortar:
   b. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.
   c. KBS-Mortar Seal, International Protective Coatings Corp.

10. Pillows/Bags:
    a. Firestop Pillows, Bio Fireshield, Inc.
    b. KBS Sealbags, International Protective Coatings Corp.

11. Silicone Foams: 
SECTION 07 84 00
FIRESTOPPING

a. Dow Corning Fire Stop Foam 2001, Dow Corning Corp.
b. Pensil 200 Foam, General Electric Co.

12. Silicone Sealants:

a. 3M Fire Barrier Sealant 2000, 3M Fire Protection Products
b. 3M Fire Barrier Sealant 2003, 3M Fire Protection Products
c. Pensil 100 Firestop Sealant, General Electric Co., 3M Fire Protection Products
d. CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
g. Fyre-Sil, Tremco Inc.
h. Fyre-Sil S/L, Tremco Inc.

13. Solvent-Release-Curing Intumescent Sealants:

a. Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.

2.03 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.

B. Sealant Colors: Provide color of exposed joint sealants to comply with the following:

1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.

1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

   a. 50 percent movement in both extension and compression for a total of 100 percent movement.

D. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.

E. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

F. Products: Subject to compliance with requirements, provide one of the following:
SECTION 07 84 00

FIRESTOPPING

1. Single-Component, Neutral-Curing, Silicone Sealant:
   a. Dow Corning 790, Dow Corning Corp.
   b. Dow Corning 795, Dow Corning Corp.
   c. Silpruf, General Electric Co.
   d. Ultraglaze, General Electric Co.
   e. 864, Pecora Corp.

2. Multicomponent, Nonsag, Urethane Sealant:
   a. Vulkem 922, Mameco International Inc.
   b. Dynflex, Pecora Corp.
   c. Dynatred, Pecora Corp.
   d. Dynatrol II, Pecora Corp.
   e. Sikaflex 2cn NS, Sika Corp.
   f. Sonolastic NP 2, Sonneborn Building Products Div., ChemRex Inc.
   g. Dymeric, Tremco Inc.

3. Single-Component, Nonsag, Urethane Sealant:
   a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
   b. Isoflex 881, Harry S. Peterson Co., Inc.
   c. Vulkem 921, Mameco International Inc.
   d. Sikaflex--15LM, Sika Corp.

2.04 MIXING
   A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

2.05 MATERIALS, GENERAL
   A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Architectural Sealants: Not more than 250 g/L.
      b. Nonmembrane Roof Sealants: 300 g/L.
      c. Single-Ply Roof Membrane Sealants: 450 g/L.
      d. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
      e. Sealant Primers for Porous Substrates: Not more than 775 g/L.
      f. Modified Bituminous Sealant Primers: 500 g/L.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting
SECTION 07 84 00

FIRESTOPPING

performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:

1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form release agents from concrete.

B. Priming: Prime substrates where recommended by firestopping 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 firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.03 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.

B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 INSTALLING FIRE-RESISTIVE JOINT SEALANTS
SECTION 07 84 00

FIRESTOPPING

A. General: Comply with the “System Performance Requirements” article in Part 1, with ASTM C 1193, and with the sealant manufacturer’s installation instructions and drawings pertaining to products and applications indicated.

B. Install joint fillers 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 and develop fire-resistance rating required.

C. 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 width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.

D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.05 CLEANING

A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

B. Protect firestopping 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 firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07 84 00
PART 1 - GENERAL

1.1 SUMMARY

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

B. See Division 8 Section "Glazing" for glazing sealants.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

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

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Preconstruction field test reports.

D. Compatibility and adhesion test reports.

E. Product certificates.

1.4 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.
SECTION 07 90 00

JOINT SEALANTS

C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Multicomponent Nonsag Polysulfide Sealant:

1. Available Products:
   a. Pacific Polymers, Inc.; Elasto-Seal 227 Type II (Gun Grade).
   b. Pecora Corporation; Synthacalk GC-2+.
   d. PolySpec Corp.; T-2235-M.
   e. PolySpec Corp.; T-2282.
   f. PolySpec Corp.; Thiokol 2P.
   g. Sonneborn, Division of ChemRex Inc.; Sonolastic Polysulfide Sealant.

2. Type and Grade: M (multicomponent) and NS (nonsag).
4. Use Related to Exposure: T (traffic), NT (nontraffic), T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

F. Multicomponent Nonsag Immersible Polysulfide Sealant:

1. Available Products:
   b. PolySpec Corp.; T-2235-M.

2. Type and Grade: M (multicomponent) and NS (nonsag).
4. Uses Related to Exposure: T (traffic), NT (nontraffic), and I (immersible), Class 1.
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

G. Multicomponent Pourable Polysulfide Sealant:

1. Available Products:
JOINT SEALANTS

b. Pacific Polymers, Inc.; Elastoseal 227 Type I (Pourable).

2. Type and Grade: M (multicomponent) and P (pourable).
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

H. Single-Component Nonsag Polysulfide Sealant:

1. Available Products:
   a. Pacific Polymers, Inc.; Elastoseal 230 Type I (Gun Grade).
   b. Polymeric Systems Inc.; PSI-7000.
2. Type and Grade: S (single component) and NS (nonsag).
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

I. Multicomponent Nonsag Neutral-Curing Silicone Sealant:

1. Available Products:
   a. Dow Corning Corporation; 756 H.P.
2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

J. Single-Component Pourable Neutral-Curing Silicone Sealant:

1. Available Products:
   a. Dow Corning Corporation; 890-SL.
   b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
   c. Dow Corning Corporation; SL Parking Structure Sealant.
2. Type and Grade: S (single component) and P (pourable).
3. Class: 100/50.
4. Use Related to Exposure: NT and T (traffic).
5. Uses Related to Joint Substrates: M, A and O, as applicable to joint substrates indicated.

K. Single-Component Neutral- and Basic-Curing Silicone Sealant:

1. Available Products:
   a. Dow Corning Corporation; 790.
   b. GE Silicones; SilPruf LM SCS2700.
JOINT SEALANTS

c.  Tremco; Spectrem 1 (Basic).
d.  GE Silicones; SilPruf SCS2000.
e.  Pecora Corporation; 864.
f.  Pecora Corporation; 890.
g.  Polymeric Systems Inc.; PSI-641.
h.  Sonneborn, Division of ChemRex Inc.; Omniseal.
i.  Tremco; Spectrem 3.
j.  Dow Corning Corporation; 791.
k.  Dow Corning Corporation; 795.
l.  GE Silicones; SilPruf NB SCS9000.
m.  GE Silicones; UltraPruf II SCS2900.
n.  Pecora Corporation; 865.
o.  Pecora Corporation; 895.
p.  Pecora Corporation; 898.

2.  Type and Grade:  S (single component) and NS (nonsag).
3.  Class:  50.
4.  Use Related to Exposure:  NT (nontraffic).
5.  Uses Related to Joint Substrates:  M, G, A, and, as applicable to joint substrates indicated, O.

L.  Single-Component Neutral-Curing Silicone Sealant:

1.  Available Products:
   a.  Dow Corning Corporation; 799.
   b.  GE Silicones; UltraGlaze SSG4000.
   c.  GE Silicones; UltraGlaze SSG4000AC.
   f.  Tremco; Proglaze SG.
   g.  Tremco; Spectrem 2.
   h.  Tremco; Tremsil 600.

2.  Type and Grade:  S (single component) and NS (nonsag).
4.  Use Related to Exposure:  NT (nontraffic).
5.  Uses Related to Joint Substrates:  M, G, A, and, as applicable to joint substrates indicated, O.

M.  Single-Component Acid-Curing Silicone Sealant:

1.  Available Products:
   a.  Bostik Findley; Chem-Calk 1200.
   b.  Dow Corning Corporation; 999-A.
   c.  Dow Corning Corporation; Trademate Glazing.
   d.  GE Silicones; Construction SCS1200.
   e.  GE Silicones; Contractors SCS1000.
   f.  GE Silicones; Sanitary SCS1700.
   g.  Pecora Corporation; 860.
   h.  Polymeric Systems Inc.; PSI-601.
SECTION 07 90 00

JOINT SEALANTS

i. Polymeric Systems Inc.; PSI-613.
k. Sonneborn, Division of ChemRex Inc.; OmniPlus.
l. Tremco; Proglaze.
m. Tremco; Tremsil 200.

2. Type and Grade: S (single component) and NS (nonsag).
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

N. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:

1. Available Products:
   a. Pecora Corporation; 898.
   b. Tremco; Tremsil 600 White.

2. Type and Grade: S (single component) and NS (nonsag).
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

O. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Available Products:
   a. Dow Corning Corporation; 786 Mildew Resistant.
   b. GE Silicones; Sanitary SCS1700.
   c. Tremco; Tremsil 200 White.

2. Type and Grade: S (single component) and NS (nonsag).
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

P. Multicomponent Nonsag Urethane Sealant:

1. Available Products:
   a. Pecora Corporation; Dynatrol II.
   b. Tremco; Dymeric 511.
   c. Tremco; Vulkem 922.

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use(s) Related to Exposure: NT (nontraffic) and [T (traffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

Q. Multicomponent Nonsag Urethane Sealant:
SECTION 07 90 00

JOINT SEALANTS

1. Available Products:
   b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
   c. Sonneborn, Division of ChemRex Inc.; NP 2.
   d. Tremco; Vulkem 227.
   e. Tremco; Vulkem 322 DS.

2. Type and Grade: M (multicomponent) and NS (nonsag).
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [G,]A, and, as applicable to joint substrates indicated, O.

R. Multicomponent Nonsag Urethane Sealant:

1. Available Products:
   a. Bostik Findley; Chem-Calk 500.
   b. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Gun Grade).
   c. Polymeric Systems Inc.; PSI-270.
   d. Tremco; Dymeric.

2. Type and Grade: M (multicomponent) and NS (nonsag).
4. Additional Movement Capability: 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
5. Use Related to Exposure: NT (nontraffic).
6. Uses Related to Joint Substrates: M, [G,]A, and, as applicable to joint substrates indicated, O.

S. Multicomponent Nonsag Urethane Sealant:

1. Available Products:
   a. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type II (Gun Grade).
   b. Pacific Polymers, Inc.; Elasto-Thane 227 Type II (Gun Grade).
   c. Pecora Corporation; Dynatred.
   d. Polymeric Systems Inc.; PSI-270.

2. Type and Grade: M (multicomponent) and NS (nonsag).
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

T. Multicomponent Nonsag Immersible Urethane Sealant:

1. Available Products:
   a. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Gun Grade).
   b. Pecora Corporation; Dynatred.
   c. Tremco; Vulkem 227.
   d. Tremco; Vulkem 322 DS.
SECTION 07 90 00

JOINT SEALANTS

2. Type and Grade: M (multicomponent) and NS (nonsag).
4. Use Related to Exposure: T (traffic), NT (nontraffic) and I (immersible), Class 1.
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

U. Multicomponent Pourable Urethane Sealant:

1. Available Products:
   b. Meadows, W. R., Inc.; POURTHANE.
   c. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type I (Self Leveling).
   d. Pacific Polymers, Inc.; Elasto-Thane 227 Type I (Self Leveling).
   e. Pecora Corporation; Urexpan NR-200.
   f. Polymeric Systems Inc.; PSI-270SL.
   g. Schnee-Morehead, Inc.; Permathane SM 7201.
   h. Tremco; THC-901.
   i. Tremco; THC-900.
   j. Tremco; Vulkem 245.
   k. Pecora Corporation; Urexpan NR 300, Type H.
   l. Pecora Corporation; Urexpan NR 300, Type M.

2. Type and Grade: M (multicomponent) and P (pourable).
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

V. Multicomponent Pourable Urethane Sealant:

1. Available Products:
   a. Pecora Corporation; Dynatrol II-SG.
   b. Sika Corporation, Inc.; Sikaflex - 2c SL.
   c. Sonneborn, Division of ChemRex Inc.; SL 2.

2. Type and Grade: M (multicomponent) and P (pourable).
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

W. Multicomponent Pourable Immersible Urethane Sealant:

1. Available Products:
   a. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Self Leveling).
   b. Tremco; Vulkem 245.

2. Type and Grade: M (multicomponent) and P (pourable).
4. Uses Related to Exposure: T (traffic), NT (nontraffic) and I (immersible), Class 1.
SECTION 07 90 00

JOINT SEALANTS

5. Uses Related to Joint Substrates: M, [G, ]A, and, as applicable to joint substrates indicated, O.

X. Single-Component Nonsag Urethane Sealant:

1. Available Products:
   b. Sonneborn, Division of ChemRex Inc.; Ultra.
   c. Sonneborn, Division of ChemRex Inc.; NP 1.
   d. Tremco; Vulkem 116.

2. Type and Grade: S (single component) and NS (nonsag).
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [G, ]A, and, as applicable to joint substrates indicated, O.

Y. Single-Component Nonsag Urethane Sealant:

1. Available Products:
   a. Bostik Findley; Chem-Calk 900.
   b. Bostik Findley; Chem-Calk 915.
   c. Bostik Findley; Chem-Calk 916 Textured.
   d. Bostik Findley; Chem-Calk 2639.
   e. Pecora Corporation; Dynatrol I-XL.
   f. Polymeric Systems Inc.; Flexiprene 1000.
   g. Polymeric Systems Inc.; PSI-901.
   h. Schnee-Morehead, Inc.; Permathane SM7100.
   i. Schnee-Morehead, Inc.; Permathane SM7108.
   k. Sika Corporation, Inc.; Sikaflex 15LMg
   l. Tremco; DyMonic.
   m. Tremco; Vulkem 921.
   n. Tremco; Vulkem 931.

2. Type and Grade: S (single component) and NS (nonsag).
4. Uses Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

Z. Multicomponent Nonsag Immersible Urethane Sealant:

1. Available Products:
   a. Tremco; Vulkem 116.
   b. Tremco; Vulkem 921.

2. Type and Grade: M (multicomponent) and P (pourable).
4. Uses Related to Exposure: T (traffic) and NT (nontraffic), NT (nontraffic) and I (immersible), Class 1.
SECTION 07 90 00

JOINT SEALANTS

5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

AA. Single-Component Pourable Urethane Sealant:

1. Available Products:
   a. Sika Corporation, Inc.; Sikaflex - 1CSL.
   b. Sonneborn, Division of ChemRex Inc.; SL 1.
   c. Tremco; Vulkem Nova 300 SSL.

2. Type and Grade: S (single component) and P (pourable).
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

BB. Single-Component Pourable Urethane Sealant:

1. Available Products:
   a. Bostik Findley; Chem-Calk 950.
   b. Pecora Corporation; Urexpan NR-201.
   e. Tremco; Tremflex S/L.
   f. Tremco; Vulkem 45.

2. Type and Grade: S (single component) and P (pourable).
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

2.4 SOLVENT-RELEASE JOINT SEALANTS

A. Acrylic-Based Solvent-Release Joint Sealant: Comply with ASTM C 1311 or FS TT-S-00230.

1. Available Products:
   b. Tremco; Mono 555.


1. Available Products:
   a. Bostik Findley; Bostik 300.
   b. Fuller, H. B. Company; SC-0296.
   c. Fuller, H. B. Company; SC-0288.
   d. Pecora Corporation; BC-158.
   e. Polymeric Systems Inc.; PSI-301.
JOINT SEALANTS

f. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
g. Tremco; Tremco Butyl Sealant.

c. Pigmented Narrow-Joint Sealant: Manufacturer's standard, solvent-release-curing, pigmented, synthetic-rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch (5 mm) or smaller in width.

1. Available Products:
   a. Fuller, H. B. Company; SC-0289.

2.5 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type O P, Grade NF.

B. Available Products:
   1. Bostik Findley; Chem-Calk 600.
   4. Sonneborn, Division of ChemRex Inc.; Sonolac.
   5. Tremco; Tremflex 834.

2.6 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Available Products:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Available Products:
   a. Pecora Corporation; BA-98.
   b. Tremco; Tremco Acoustical Sealant.

2.7 PREFORMED JOINT SEALANTS

A. Prefomed Silicone-Sealant System: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.
SECTION 07 90 00

JOINT SEALANTS

1. Available Products:
   a. Dow Corning Corporation; 123 Silicone Seal.
   b. GE Silicones; UltraSpan US1100.
   c. Pecora Corporation; Sil-Span.
   d. Tremco; Spectrem Ez Seal.

B. Preformed Foam Sealant: Manufacturer's standard mildew-resistant, nonmigratory, nonstaining, preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent.

1. Available Products:
   a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
   b. illbruck Sealant Systems, Inc.; Wilseal 600.
   c. Polytite Manufacturing Corporation; Polytite B.
   d. Polytite Manufacturing Corporation; Polytite Standard.
   e. Sandell Manufacturing Co., Inc.; Polysell.
   f. Density: Manufacturer's standard 5.5 to 6.5 lb/cu. ft. (90 to 110 kg/cu. M).

2.8 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 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
SECTION 07 90 00

JOINT SEALANTS

harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

   a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.

   a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer’s written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

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

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
SECTION 07 90 00
JOINT SEALANTS

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Installation of Preformed Silicone-Sealant System: Comply with manufacturer’s written instructions.

H. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

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

3.3 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Vertical control and expansion joints on exposed interior surfaces of exterior walls.

B. Joint-Sealant Application: Interior perimeter joints of exterior openings.
SECTION 07 90 00

JOINT SEALANTS


C. Joint-Sealant Application: Interior ceramic tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

1. Joint Sealant: Multicomponent pourable polysulfide sealant, Multicomponent nonsag urethane sealant, Multicomponent pourable urethane sealant or Single-component pourable urethane sealant.


D. Joint-Sealant Application: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.


E. Joint-Sealant Application: Vertical joints on exposed surfaces of interior unit masonry and concrete walls and partitions.


F. Joint-Sealant Application: Perimeter joints between interior wall surfaces and frames of interior doors and windows.


G. Joint-Sealant Application: Interior control, expansion, and isolation joints in horizontal traffic surfaces of flooring.

1. Joint Sealant: Multicomponent pourable polysulfide sealant, Multicomponent nonsag urethane sealant, Multicomponent pourable urethane sealant or Single-component pourable urethane sealant.


END OF SECTION 07 90 00
SECTION 08 11 00
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Standard hollow metal doors and frames.

B. Related Sections:
   1. Division 8 Section "Door Hardware" for door hardware for hollow metal doors.
   2. Division 9 Sections "Interior Painting" for field painting hollow metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
SECTION 08 11 00
STEEL DOORS AND FRAMES

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch (102-mm) high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Benchmark; a division of Therma-Tru Corporation.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
SECTION 08 11 00
STEEL DOORS AND FRAMES

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer’s standard polystyrene, polyurethane, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
   3. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with a operable thermal-resistance value (R-value) of not less than 3.4 and U-factor 0.29, when tested according to ASTM C 1363.
      1) Locations: Exterior doors.
   6. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.
SECTION 08 11 00

STEEL DOORS AND FRAMES

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty).
2. Size as indicated on plans.

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty).
2. Size as indicated on plans.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.


1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
4. Frames for borrow lites, same as adjacent door frame.
5. Frames for Wood Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
SECTION 08 11 00

STEEL DOORS AND FRAMES

2. Stud-Wall Type: Designed to engage stud, welded to back of frames: not less than 0.042 inch (1.0 mm) thick.

3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.7 LOUVERS

A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of cold-rolled steel sheet set into 0.032 -inch- (0.8-mm-) thick steel frame.
   1. Sight proof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.
D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      1) Three anchors per jamb up to 60 inches (1524 mm) high.
      2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
      5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
   b. Post installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
SECTION 08 11 00

STEEL DOORS AND FRAMES

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
SECTION 08 11 00

STEEL DOORS AND FRAMES

3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer’s written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

   a. At fire-protection-rated openings, install frames according to NFPA 80.

   b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

   c. Install frames with removable glazing stops located on secure side of opening.

   d. Install door silencers in frames before grouting.

   e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

   f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

   g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.


4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.

5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
SECTION 08 11 00

STEEL DOORS AND FRAMES

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with hollow metal manufacturer's written instructions.

   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 00
SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Division 8 Section "Glazing" for glass view panels in flush wood doors.
2. Division 9 Sections "Interior Painting" and "Wood Stains and Transparent Finishes" for field finishing doors.

1.3 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

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 edges representing actual materials to be used.

a. Provide samples for each species of veneer and solid lumber required.
FLUSH WOOD DOORS

b. Provide samples for each color, texture, and pattern of plastic laminate required.

c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

3. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

E. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

C. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

D. Forest Certification: Provide doors made with cores veneers all wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

E. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 humidity range percent during the remainder of the construction period.
SECTION 08 14 16

FLUSH WOOD DOORS

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
   b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Algoma Hardwoods, Inc.
2. Ampco, Inc.
3. Buell Door Company Inc.
4. Chappell Door Co.
5. Eagle Plywood & Door Manufacturing, Inc.
7. Graham; an Assa Abloy Group company.
8. Haley Brothers, Inc.
10. Ipik Door Company.
11. Lambton Doors.
12. Marlite.
14. Mohawk Flush Doors, Inc.; a Masonite company.
15. Oshkosh Architectural Door Company.
17. Vancouver Door Company.
18. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade: Heavy Duty.
C. WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise indicated.

D. Structural-Composite-Lumber-Core Doors:
      a. Screw Withdrawal, Face: 700 lbf (3100 N).
      b. Screw Withdrawal, Edge: 400 lbf (1780 N).
   2. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

   A. Interior Solid-Core Doors:
      1. Grade: Premium, with Grade A faces.
      2. Species: Match existing doors.
      3. Cut: Match existing doors.
      5. Assembly of Veneer Leaves on Door Faces: Center-balance.
      6. Pair and Set Match: Provide for doors hung in same opening.
      7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
      8. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
      9. Exposed Vertical, Top and Bottom Edges: Same species as faces.
     10. Core: Structural Composite Lumber wood stave.
     11. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LOUVERS AND LIGHT FRAMES

   A. Metal Louvers:
      1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         a. Air Louvers Inc.
         b. Anemostat; a Mestek company.
         c. Hiawatha Incorporated.
         d. L & L Louvers, Inc.
         e. LL Building Products, Inc.; a division of GAF Materials Corporation.
         f. Louvers & Dampers, Inc.; a Mestek company.
         g. McGill Architectural Products.
         h. Kruger.
      2. Blade Type: Vision-proof, inverted V.
 SECTION 08 14 16

FLUSH WOOD DOORS

3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, with baked-enamel- or powder-coated finish.

B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Manufacturer's standard shape.
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.

1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.

D. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 8 Section "Glazing."

2.6 SHOP PRIMING

A. Doors for Transparent Finish: Shop prime doors with stain (if required), other required pretreatments, and first coat of finish as specified in Division 9 Section Interior Painting Wood Stains and Transparent Finishes." Seal all four edges, edges of cutouts, and mortises with first coat of finish.

2.7 FACTORY FINISHING
SECTION 08 14 16

FLUSH WOOD DOORS

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on edges of cutouts, and mortises.

B. Finish doors at factory.

C. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

D. Finish doors at factory where indicated in schedules or on Drawings as factory finished.

E. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI TR-5 catalyzed polyurethane system.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish, produced by applying an additional finish coat to partially fill the wood pores.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed doorframes 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. Installation Instructions: Install doors to comply with manufacturer’s written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. 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.
SECTION 08 14 16

FLUSH WOOD DOORS

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.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

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 that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 41 16
SECTION 08 31 00
ACCESS DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Access doors and frames for walls and ceilings.

B. Related Sections include the following:

1. Division 9 Section "Acoustical Tile Ceilings" for suspended acoustical tile ceilings.
2. Division 15 Section "Duct Accessories" for heating and air-conditioning duct access doors.

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire rating materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect’s acceptance of manufacturer’s standard-size units, which may vary slightly from sizes indicated.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS
SECTION 08 31 00

ACCESS DOORS

A. Steel Sheet: with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

   1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."

   2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

   3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

   4. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Dur-Red Products.
   2. Milcor Inc.


   1. Locations: Wall and ceiling surfaces.
   2. Door: Minimum [0.060-inch- (1.5-mm-) ] thick sheet metal, set flush with exposed face flange of frame.
   3. Frame: Minimum [0.060-inch- (1.5-mm-) ] thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
   4. Hinges: Continuous piano.
   5. Latch: Cam latch operated by screwdriver with interior release.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

   1. Exposed Flanges: Nominal 1 to 1-1/2 inches (25 to 38 mm) wide around perimeter of frame.
SECTION 08 31 00

ACCESS DOORS

2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION
SECTION 08 41 00
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following:
      1. Interior aluminum-framed storefronts.
         a. Glazing is retained mechanically with gaskets on four sides.
      2. Interior manual-swing aluminum doors.
   B. Related Sections include the following:
      1. Division 7 Section "Joint Sealants" for installation of joint sealants installed with
         aluminum-framed systems and for sealants to the extent not specified in this Section.
      2. Division 8 Section "Door Hardware" for hardware to the extent not specified in this
         Section.
      3. Division 8 Section "Glazing" for glazing requirements to the extent not specified in this
         Section.

1.3 PERFORMANCE REQUIREMENTS
   A. General: Provide aluminum-framed systems, including anchorage, capable of withstanding,
      without failure, the effects of the following:
      1. Structural loads.
      2. Thermal movements.
      3. Movements of supporting structure indicated on Drawings including, but not limited to,
         deflection from uniformly distributed and concentrated live loads.
      4. Dimensional tolerances of building frame and other adjacent construction.
      5. Failure includes the following:
         a. Deflection exceeding specified limits.
         b. Thermal stresses transferred to building structure.
         c. Framing members transferring stresses, including those caused by thermal and
            structural movements, to glazing.
         d. Glazing-to-glazing contact.
         e. Noise or vibration created by wind and thermal and structural movements.
         f. Loosening or weakening of fasteners, attachments, and other components.
         g. Sealant failure.
         h. Failure of operating units to function properly.
SECTION 08 41 00
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

B. Structural Loads:

1. Wind Loads: As indicated on Structural Drawings.
2. Seismic Loads: As indicated on Structural Drawings.

C. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span up to 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity but not less than 10 seconds.

E. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration Under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

H. Water Penetration Under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

I. Average Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having average U-factor of not more than 0.61 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.
1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. For entrances, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of systems, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
   1. Joinery.
   2. Glazing.

E. Qualification Data: For Installer.

F. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Capable of assuming engineering responsibility and performing work of this Section and who is acceptable to manufacturer.
   1. Engineering Responsibility: Preparation of data for aluminum-framed systems including Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

B. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

C. Accessible Entrances: Comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
D. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code-Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating aluminum-framed systems without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals, metal finishes and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.
   e. Water leakage through fixed glazing and framing areas.
   f. Failure of operating components to function properly.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Arch Aluminum & Glass Co., Inc.
2. CMI Architectural Products, Inc.
3. Commercial Architectural Products, Inc.
4. EFCO Corporation.
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

5. Kawneer.
7. Tubelite Inc.
8. United States Aluminum.
10. Western Window Systems.
11. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

E. Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials. Form exposed flashing from sheet aluminum finished to
SECTION 08 41 00
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

match framing and of sufficient thickness to maintain a flat appearance without visible deflection.

F. Framing System Gaskets and Sealants: Manufacturer’s standard recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section “Glazing.”

B. Glazing Gaskets: Manufacturer’s standard compression types, replaceable, molded or extruded, that maintain uniform pressure and watertight seal.

C. Spacers and Setting Blocks: Manufacturer’s standard elastomeric types.

D. Bond-Breaker Tape: Manufacturer’s standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

2.5 DOORS

A. Doors: Manufacturer’s standard glazed doors, for manual swing operation.

1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch-(3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie rods.

2. Door Design: Match existing stile.


   a. Provide nonremovable glazing stops on outside of door.

B. Door Hardware: As specified in Division 8 Section “Door Hardware.”

1. Opening-Force Requirements:

   a. Egress Doors: Not more than 30 lbf (133 N) required to set door in motion and not more than 15 lbf (67 N) required to open door to minimum required width.

   b. Accessible Interior Doors: Not more than 5 lbf (22.2 N).

2.6 ACCESSORY MATERIALS

A. Insulating Materials: As specified in Division 7 Section “Building Insulation.”

B. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section “Joint Sealants.”
SECTION 08 41 00
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

C. 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.

2.7 FABRICATION

A. Form aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing (without projecting stops).

E. Door Frames: Reinforce as required to support loads imposed by door operation and for installing hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

F. Doors: Reinforce doors as required for installing hardware.

1. At pairs of exterior doors, provide sliding weather stripping retained in adjustable strip mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Hardware Installation: Factory install hardware to the greatest extent possible. Cut, drill, and tap for factory-installed hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
SECTION 08 41 00

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

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

C. Fluorocarbon Three-Coat Coating System: Manufacturer's standard three-coat thermo-cured system composed of specially formulated inhibitive primer and fluorocarbon color coat and clear fluorocarbon topcoat with both color coat and clear topcoat containing not less than 70% polyvinylidene fluoride resin by weight; comply with AAMA 605.2.

D. Match existing finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

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

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight, unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."
G. Entrances: Install to produce smooth operation and tight fit at contact points.
   1. Exterior Entrances: Install to produce tight fit at weather stripping and weathertight closure.
   2. Field-Installed Hardware: Install surface-mounted hardware according to hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install insulation materials as specified in Division 7 Section "Building Insulation."

I. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" and to produce weathertight installation.

J. Erection Tolerances: Install aluminum-framed systems to comply with the following maximum tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
   3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch (3 mm).

3.3 CLEANING
   A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.
   B. Clean glass surfaces after installation, complying with requirements contained in the "Glazing" section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.4 PROTECTION
   A. Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.5 ADJUSTING
   A. Entrances: Adjust operating hardware for smooth operation according to hardware manufacturers' written instructions.
      1. For doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch measured to the leading door edge.
SECTION 08 41 00

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

END OF SECTION 08 41 00
PART 1  GENERAL

1.01  RELATED DOCUMENTS

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

1.02  SUMMARY

A. This Section includes the following types of automatic doors:

1. Single slide/swing panel with swing out sidelite.

2. Bi-parting slide/swing panels with swingout sidelite.

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Glazing requirements for automatic entrance doors, including entrances specified to be factory glazed, are included in Section 08800 "Glass and Glazing".

2. Lock cylinders are included in Section 08700 "Finish Hardware".

1.03  DEFINITIONS

A. Automatic entrance doors consist of the manufacturer's assembled automatic entrance door units including entrance doors and frames, door operator controls, powered door operators, and accessories.

1.04  SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide automatic entrance door assemblies that comply with performance characteristics specified as demonstrated by testing the manufacturer's corresponding stock assemblies according to test methods indicated.

B. Thermal Movement: Design the automatic entrance door systems to provide for expansion and contraction of the component materials. Doors shall function normally over the specified temperature range.

1. The system shall be capable of withstanding a metal surface temperature range of 180° F. (100° C.) without buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, stress on glass, or other detrimental effects.

C. Design Requirements: Provide automatic entrance door systems that comply with performance requirements indicated.

1. Wind Loads: Provide automatic entrance door assemblies capable of withstanding wind pressure of 20 psf inward and 20 psf outward acting normal to the plane of the wall.

D. Transmission Characteristics: Provide automatic entrance doors with jamb and head frames that limit air leakage to a rate not to exceed 1.25 cfm per square foot of door
SECTION 08 42 29

AUTOMATIC ENTRANCE DOORS

area when tested in accordance with ASTM E 283 at an inward pressure differential of 1.567 psf.

E. Operator: Provide operators that will open and close doors and maintain them in fully closed position when subjected to a 20 mph wind velocity or the equivalent inward differential pressure.

1.05 SUBMITTALS

A. General: Submit the following in accordance with Section 01300.

B. Product data for each automatic entrance required, including the manufacturer's standard details and fabrication methods and the following:

1. Data on operators, hardware and accessories.

2. Roughing-in diagrams.

3. Parts lists.

4. Data on finishes and recommendations for maintenance and cleaning of exterior surfaces.

C. Shop drawings for automatic entrance required, including:

1. Layout and installation details, including relationship to adjacent work.

2. Elevations at 1/4" scale.

3. Detail sections of typical composite members.

4. Anchors and reinforcement.

5. Hardware mounting heights.


7. Glazing details.

D. Wiring diagrams detailing wiring for power operator, signal, and control systems differentiating clearly between manufacturer-installed wiring and field-installed wiring.

E. Hardware Schedule: Submit complete hardware schedule for automatic entrance doors organized into sets based on hardware specified. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function and finish. Coordinate hardware for automatic entrance doors with hardware required for the rest of the Project. Include name of the item and the manufacturer and complete designations of every item required for each entrance.

F. Samples for Initial Color Selection: Submit pairs of samples of each specified color and finish on 12" long sections of extrusions or formed shapes. Where normal color variations are anticipated, include two or more units in each set of samples indicating extreme limits of color variations.
G. Maintenance Data: Submit manufacturer’s maintenance and service data for door operators and control system including the name, address and telephone number of the nearest authorized service representative.

H. Test Reports: Provide certified test reports from a qualified independent testing laboratory showing that automatic entrance door systems have been tested in accordance with specified test procedures and comply with performance characteristics indicated.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: For installation of the automatic entrance doors, engage an experienced Installer who is an authorized representative of the manufacturer for both the installation and maintenance of the type of units required for this project.

B. BHMA Standard: Provide automatic entrance door units that comply with applicable requirements of ANSI A156.10 (BHMA 1601), Power Operated Pedestrian Door Standard.

C. UL Standard: Provide powered door operators that comply with UL 325.

D. Emergency Exit Doors: Automatic entrance doors serving as a required means of egress shall comply with requirements of authorities having jurisdiction. Provide manufacturer’s certification that doors comply with these requirements.

1.07 PROJECT CONDITIONS

A. Field Measurements: Check openings by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work.

1. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

1.08 WARRANTY

A. Submit a written warranty, executed by the manufacturer, agreeing to repair or replace components of the automatic entrance door system that fail in materials or workmanship within the specified warranty period. Failures include, but are not necessarily limited to:

1. Structural failures including excessive deflection, excessive leakage or air infiltration.

2. Faulty operation of operators and hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: Three (3) years after the date of Substantial Completion.

1. The warranty shall not deprive AAFES of other rights or remedies that AAFES may have under other provisions of the Contract Documents and is in addition to, and runs concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide automatic entrance doors from one of the following:

1. Electro-Mechanical-Operated Sliding Units:
   a. Horton Automatics, Division of Overhead Door Corp.
      1) Electric Operator, Series 2000 Linear Drive, Profiler.
   b. Dor-O-Matic, Division of Republic Industries, Inc.
   c. Stanley Magic-Door, Division of the Stanley Works.

2.02 MATERIALS

A. Aluminum Members: Alloy and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish. Comply with ASTM B 221 for aluminum extrusions; ASTM B 209 for aluminum sheet or plate; and ASTM B 211 for aluminum bars, rods, and wire.

1. Provide main extrusions of not less than 0.125" wall thickness.

2. Provide extruded glazing stops and other applied trim extrusions with minimum wall thickness of 0.062".

B. Fasteners: Provide aluminum, non-magnetic stainless steel, or other non-corrosive metal fasteners compatible with aluminum components, hardware, anchors, and other items being fastened.

1. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125" thick, reinforce the interior with aluminum or non-magnetic stainless steel to receive screw threads, or provide standard non-corrosive pressed-in, splined grommet nuts.

2. Exposed Fasteners: Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match the finish of member or hardware being fastened.

C. Brackets and Reinforcements: Provide high-strength aluminum brackets and reinforcements. Where use of aluminum is not feasible, provide non-magnetic stainless steel or hot-dip galvanized steel complying with ASTM A 123.

D. Sliding Weatherstripping: Manufacturer's standard replaceable weatherstripping of wool, polypropylene or nylon woven pile with nylon fabric and aluminum strip backing. Sliding weatherstripping includes stripping at jamb rails, head rails, and meeting rails, wherever there is no stop or lap to remove compression weatherstripping.

E. Sealants and Gaskets: Use sealants and gaskets in fabrication, assembly and installation of the work that are recommended and guaranteed by manufacturer to remain permanently elastic, non-shrinking, and non-migrating.
SECTION 08 42 29

AUTOMATIC ENTRANCE DOORS

F. Glass and Glazing Materials: Comply with requirements of Section 08800 "Glass and Glazing” of these specifications for gaskets and sealants required for glass installation at the project site.

2.03 HARDWARE

A. Provide heavy duty hardware units as indicated, scheduled or required for operation of each entrance door, including the following items of size, number, and type recommended by the manufacturer for the service required. Finish hardware items to match finish of the door.

B. Deadlock: Hookbolt type deadlocks for sliding entrance doors accepting standard mortise cylinder. 2 each, one in the top half, one in the bottom half, keyed from inside only.

C. Install hardware, except surface-mounted hardware, at the fabrication plant. Remove only as required for final finishing operation, and delivery and installation at the project site.

2.04 DOOR OPERATORS

A. Capacity: Provide operators of the size recommended by the manufacturer for door size, weight, and movement; for condition of exposure, and for long-term, maintenance-free operation under normal traffic load for the type of occupancy indicated.

B. Exposed Housing: Provide extruded or formed aluminum housing for operators of 0.062" minimum thickness with fasteners concealed when door is in the closed position. Provide access for maintenance.

C. Adjustment Features: Operators shall be fully adjustable without removal of the doors. Provide adjustment for opening, closing, and checking speeds, as well as length of time the door remains open.

E. Electro-Mechanical Operators for Sliding Doors: Provide self-contained, concealed, overhead electro-mechanical door operator with power opening and either power or spring closing, and checking for both opening and closing cycles. Include connections for power and control wiring. Provide safety release clutch for obstructed closing. Provide for easy manual sliding when power is off. Provide operator action as indicated.

1. Provide emergency breakaway swing feature.

2. Provide concealed overhead operators with connections for power and control wiring.

2.05 DOOR CONTROL SYSTEMS

A. Infrared Motion-Detecting Control System: Provide self-contained, motion-detecting control system composed of an infrared sensing device to activate door operator and a horizontal photo-cell beam across door opening to prevent door from closing until door is clear of traffic. Sensing device shall be adjustable to provide detection patterns and sensitivity equivalent to those required formats. Provide housing for sensing device finished to match finish of doors and frames.
SECTION 08 42 29

AUTOMATIC ENTRANCE DOORS

1. Install scanners on both interior and exterior of each automatic sliding entrance door.

B. Wall-Mounted, Push-Plate Control System: Provide the manufacturer's standard recessed or surface-mounted, momentary-contact-type wall plate actuator switch door operator control system for use by the handicapped. Engrave wall plate with universal handicapped symbol. Provide push-plates on both sides of the opening.

C. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent operation of the unit when operation of the door is prevented by lock and latch or door bolts.

2.06 ACCESSORIES

A. Equip rails with filler panels of expanded aluminum mesh for maximum control of traffic on and of floor mat control panels.

B. Sill Configuration at Sliding Entrance Doors: Provide sill members and bottom guide system of configuration indicated.

C. Provide threshold across door opening and inverted roller guide track system at sidelights.

D. Provide threshold across door opening and pin guide track system at sidelights.

2.07 FABRICATION

A. General: Fabricate automatic entrance door system components to designs, sizes and thicknesses indicated and to comply with indicated standards.

B. Prefabrication: Provide automatic entrance doors as prefabricated packaged units complete with doors, frames, sidelights, transoms where indicated door operators and related components, hardware, and accessories. Complete fabrication, assembly, finishing, hardware applications and other work before shipment to project site.

1. Preglaze door and frame units to greatest extent possible, in coordination with installation and hardware requirements.

2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.

3. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work in manner which prevents damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.

C. Welding: Comply with AWS recommendations. Grind exposed welds smooth to remove weld spatter and welding oxides. Restore mechanical finish.

1. Perform welding behind finished surfaces in such a manner as to minimize distortion and discoloration on the finished surfaces.

D. Reinforce the work as necessary for performance requirements and for support to the structure. Separate metal surfaces at moving joints with non-metallic separators to prevent "freeze-up" of joints.
SECTION 08 42 29

AUTOMATIC ENTRANCE DOORS

E. Dissimilar Metals: Separate dissimilar metals with bituminous paint, a suitable sealant, non-absorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.

F. Maintain continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.

G. Fasteners: Conceal fasteners wherever possible.

H. Weatherstripping: For exterior doors, provide compression weatherstripping against fixed stops. For exterior doors without fixed stops, provide sliding weatherstripping retained in an adjustable strip mortised into the edge of the door.

I. Aluminum Door, Sidelight and Transom Framing: Fabricate tubular and channel frame assemblies in configuration indicated with welded or mechanical joints in accordance with manufacturer's standards. Provide concealed fasteners. Reinforce internally with steel shapes as indicated or as necessary, to support the required loads.

1. Fabricate frame assemblies for exterior walls with flashing and weeps to drain penetrating moisture to the exterior. Provide anchorage and alignment brackets for concealed support of assembly from the building structure. Allow for thermal expansion of exterior units.

2.08 FINISHES

A. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Finish aluminum automatic entrance door system components to match adjacent aluminum curtain wall or storefront work.

D. Fluorocarbon Three-Coat Coating System: Manufacturer's standard three-coat thermocured system composed of specially formulated inhibitive primer and fluorocarbon color coat and clear fluorocarbon topcoat with both color coat and clear topcoat containing not less than 70% polyvinylidene fluoride resin by weight; comply with AAMA 605.2.

E. Color: Match existing finish.

PART 3 EXECUTION

3.01 PREPARATION

A. Templates and Diagrams: Furnish templates, diagrams, and other data to fabricators and installers of related work, as necessary, for coordination of the automatic entrance door installation.

3.02 INSTALLATION

A. Comply with manufacturer's specifications and recommendations.

B. Set units plumb, level, and true to line without warp or rack of frames or doors. Anchor securely in place. Separate aluminum and other corrodi(le) metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
SECTION 08 42 29

AUTOMATIC ENTRANCE DOORS

C. Set sill members in a bed of sealant or with joint fillers or gaskets as indicated to provide weathertight construction. Comply with requirements of Division 7 Sections for sealants, fillers, and gaskets, to be installed during installation of doors and frames.

1. Refer to Division 7 Sections for compounds, joint fillers, and gaskets to be installed after installation of frame assemblies.

D. Install complete door operator system in accordance with manufacturer's instructions, including piping, controls, control wiring, and remote power units.

E. Set tracks, header assemblies, operating brackets, rails and guides level and true to location with adequate anchorage for permanent support.

3.03 ADJUSTING

A. After repeated operation of complete installation, equivalent to three (3) days use by normal traffic (100 to 300 cycles), readjust door operators and controls for optimum operating condition and safety and for a weathertight closure. Lubricate hardware, operating equipment and other moving parts.

3.04 CLEANING

A. Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Exercise care to avoid damage to coatings.

1. Comply with requirements contained in Division 8 Section "Glass and Glazing" for cleaning and maintenance of glass.

3.05 PROTECTION

A. Institute protective measures required throughout the remainder of the construction period to ensure that automatic entrance doors will be without damage or deterioration, other than normal weathering, at the time of acceptance.

END OF SECTION 08 42 29
SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Door Hardware

B. Related Sections:
   1. Section 08110 - Steel Doors and Frames
   2. Section 081400 - Wood Doors

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
   3. NFPA 80 – Fire Doors
   5. NFPA 105 – Installation of Smoke Door Assemblies.

D. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards – A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

A. Product Data: Manufacturer’s product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Shop Drawings:
   1. Style and finish.
   2. Locations and mounting heights of each item of hardware. Use established numbering system
   3. Include a complete listing of equipment and materials including manufacturer, catalog number, finish, diagrams, (including cut-sheets), schematics and all other pertinent data.

C. Door Hardware Schedule: Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in Door & Hardware Institute “Sequence and Format for the Hardware Schedule”.
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.

D. Keying Schedule: Prepared by supplier, detailing Owner’s final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.
SECTION 08 71 00

DOOR HARDWARE

E. Maintenance Data: For each type of door hardware to include in maintenance manuals. Provide Manufacturer’s parts list and maintenance instructions for each type of hardware supplied and necessary wrenches and tools required for proper maintenance of hardware.

F. Certification: At the completion of installation, certify that material is properly installed according to Manufacturers printed instructions.

1.3 QUALITY ASSURANCE

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

B. Supplier Qualifications: Supplier shall meet the following criteria:
   1. Experienced commercial door hardware distributors with a minimum five years documented experience supplying, material indicated for this Project.
   2. Factory authorized distributor in good standing by the manufacturers of the primary materials with a warehousing facility.
   3. Holder of legally required licenses.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

D. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Package each item of hardware in original and individual containers, complete with all necessary fastenings, keys, instructions, and templates for spotting mortising tools.

B. Acceptance at Site: Upon delivery of the finish hardware to the job site, check in and sign for all material delivered and thereafter be responsible for same.

C. Storage and Protection: Provide a secured area with sufficient space and shelving in which to store and inventory all materials under lock and key. Protect hardware from damage at all times.

1.5 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

A. Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators and door hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
SECTION 08 71 00

DOOR HARDWARE

B. Warranty Period:
   1. Typical: 1 year from date of Substantial Completion, unless otherwise indicated.
   2. Special Warranty Periods:
      a. Five years for locks and latches
      b. Five years for exit devices
      c. Ten years for manual surface door closers

1.7 MAINTENCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner’s continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULE DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

   1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations as follows:
      a. Named Manufacturer’s Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturer’s names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 MATERIALS

A. Hinges: ANSI A156.1, full mortise type, template type. ANSI A156.7, complying with following general requirements unless otherwise scheduled.
   1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
   2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
      a. Doors Over 42 inches Wide: Heavy weight ball bearing hinges.
   4. Pins: Furnish nonferrous hinges with non-removable pins (NRP) at exterior and locked out-swing doors, non-rising pins at interior doors.

      Acceptable Manufacturers:
      a. MCKINNEY HINGE CO.
      b. IVES

B. Locksets: ANSI A156.2, Grade 1 unless otherwise indicated. Furnish locksets compatible with specified cylinders. Typical 2-3/4 inch backset. Furnish 4-7/8 inch strikes with extended lips to protect trim from being marred by latch bolts.
SECTION 08 71 00

DOOR HARDWARE

Acceptable Manufacturers:
   a. BEST LOCK CORP.
   b. FALCON LOCK DIV.
   c. ARROW LOCK DIV.
   d. SCHLAGE LOCK CO.

C. Exit Devices: ANSI A156.3, Grade 1, unless otherwise indicated. Furnish standard strikes suitable to protect trim from being marred by latch bolt.
   1. Types: Suitable for doors requiring exit devices
      Acceptable Manufacturers:
      a. PRECISION HARDWARE
      b. VON DUPRIN
      c. SARGENT DIV.

D. Cylinders And Keying: ANSI A156.5, grade 1 (7-pin), match existing keyway.
   1. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
   2. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores were specified. Provide construction master keys in quantity as required by project Contractor. Furnish permanent cores for installation as directed.
   3. Keying: keyed as directed by Owner.
      Acceptable Manufacturers:
      a. BEST LOCK CORP. - No Substitutions

E. Closers: ANSI A156.4, Grade 1. Full rack and pinion type with steel spring and all weather hydraulic fluid, closers required for fire rated doors unless otherwise indicated.
   a. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.
   b. Arms: Type to suite individual condition, parallel arm closers at reverse bevel doors.
   c. Location: Mount closers on inside of exterior doors, room side of interior doors typical, mount on pull side of other doors.
   d. Operating Pressure: Maximum operating pressure as follows.
      1. Interior Doors: Maximum 5 pounds.
      Acceptable Manufacturers:
      a. LCN
      b. NORTON CLOSERS

Furnish dust proof strikes for bottom bolts. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
      Acceptable Manufacturers:
      a. ROCKWOOD MFG. CO.
      b. IVES DIV.
      c. TRIMCO

G. Door Stops and Holders: Door stops and holders to be type and design as specified in the Hardware Sets.
SECTION 08 71 00

DOOR HARDWARE

Acceptable Manufacturers:
   a. ROCKWOOD MFG. CO.
   b. IVES DIV.
   c. TRIMCO
   d. EVERBILT

H. General: Provide Thresholds, weatherstripping, smoke gasketing, and intumescent seals as required and where shown in Hardware Sets.

Acceptable Manufacturers:
   a. NATIONAL GUARD PRODUCTS, INC.
   b. PEMKO MFG. CO.
   c. REESE ENTERPRISES, INC.

2.3 FABRICATION

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

2.4 FINISHES

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

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer’s standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Match existing finish.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with ANSI/DHI A115 series.
   1. Surface Applied Door Hardware: Drill and tap doors and frames according To SDI 107.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations.
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 “Accessibility Guidelines for Building and Facilities.”
   4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

B. Retrofitting: Install door hardware to comply with manufacturer’s templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface mounted items until finishes have been completed on substrates involved.

C. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

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

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish, and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DOOR HARDWARE SCHEDULE

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

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

B. Manufacturer’s Abbreviations:

1. ST – STANLEY HARDWARE
2. BE – BEST LOCK CORP.
3. LCN
4. PE – PEMKO
5. RO – ROCKWOOD
6. VD – VON DUPRIN
7. IV – IVES
8. SE – SENTROL
9. SC – SCHLAGE LOCK COMPANY
10. EB - EVERBILT

Hardware Schedule

Hardware Set #1
Doors 1A, 1B, 46A, 46B
Each to have:

1 Cylinder 1E74/1E72 as required BE
Balance of hardware by door supplier.

Hardware Set #2
Doors 50B, 56.2A, 56.3A, 56.6A
Each to have:

3 Spring Hinges 260R – 4.5 x 4.5 619 ST
1 Lockset AL10S-SAT 619 SC
1 Wall Stop 16096 619 EB
3 Silencers 608 RO

Hardware Set #3
Doors 54A, 56.7A
Each to have:

3 Spring Hinges 260R – 4.5 x 4.5 619 ST
1 Lockset AL53PD-SAT 619 SC
1 Wall Stop 16096 619 EB
3 Silencers 608 RO

Hardware Set #4
Doors 53A
Each to have:

3 Spring Hinges 260R – 4.5 x 4.5 619 ST
1 Lockset AL40S-SAT 619 SC
1 Wall Stop 16096 619 RO
3 Silencers 608 RO

Hardware Set #5
SECTION 08 71 00

DOOR HARDWARE

Doors 96A, 98A
Each to have:

Provide hardware to match existing, V.I.F.

Hardware Set #6
Doors 50A
Each to have:

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<th>Quantity</th>
<th>Part Number</th>
<th>Notes</th>
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<tr>
<td>1 Lockset</td>
<td>AL53PD-SAT</td>
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<td>3 Silencers</td>
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END OF SECTION 08 71 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.

B. Related Sections include the following:

1. Division 7 Section "Joint Sealants" for sealant conditions not specified herein.
2. Division 8 Section "Steel Doors and Frames." for glass lites and sidelights.
3. Division 8 Section "Flush Wood Doors" for glass lites.
4. Division 8 Section "Mirrors."

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
SECTION 08 81 00

GLAZING

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

   a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

      1) Basic Wind Speed: 90 MPH
      2) Exposure Category: B.

   b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

      1) Load Duration: 60 seconds or less

   c. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch (25 mm), whichever is less.

      1) For monolithic-glass lites heat treated to resist wind loads.
      2) For insulating glass.

   d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0mm.

   e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Verification Samples: For the following products, in the form of 12 inch (305 mm) square samples for insulating glass units.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
SECTION 08 81 00

GLAZING

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

E. Qualification Data: For installers.

F. Product Test Reports: For each type of glazing.

G. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

C. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

D. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

E. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

F. Glazing for Fire-Rated Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201 and, for wired glass, ANSI Z97.1.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. (0.84 sq. m) in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. (0.84 sq. m) or less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."


1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.
SECTION 08 81 00

GLAZING

B. Manufacturer’s Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in “Definitions” Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 GLASS PRODUCTS

A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.

1. Ultra-Clear (Low-Iron) Float Glass: Class I (clear); with a minimum 91 percent visible light transmission and a minimum solar heat gain coefficient of 0.87.

   a. Available Products:

      1) AFG Industries Inc.; Krystal Klear.
      2) Pilkington Building Products North America; Optiwhite.
      3) PPG Industries, Inc.; Starphire.

B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 “Performance Requirements” Article.

3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

2.3 GLAZING GASKETS
SECTION 08 81 00

GLAZING

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:

2. EPDM, ASTM C 864.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers’ written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral-Curing Silicone Glazing Sealants GS:
   a. Products:
      1) Dow Corning Corporation; 790.
      2) GE Silicones; SilPruf LM SCS2700.
      3) Tremco; Spectrem 1 (Basic).
      4) GE Silicones; SilPruf SCS2000.
      5) Pecora Corporation; 864.
      6) Pecora Corporation; 890.
      7) Polymeric Systems Inc.; PSI-641.
      8) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
      9) Tremco; Spectrem 3.
SECTION 08 81 00

GLAZING

b. Type and Grade: S (single component) and NS (nonsag).
c. Class: 100/50.
d. Use Related to Exposure: NT (nontraffic).
e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
SECTION 08 81 00

GLAZING

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) Kind FT (fully tempered) float glass.

1. Thickness: 6.0 mm

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
SECTION 08 81 00

GLAZING

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

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

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
SECTION 08 81 00

GLAZING

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
SECTION 08 81 00

GLAZING

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 81 00
PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes the following types of silvered flat glass mirrors:
      1. Annealed monolithic glass mirrors.

1.2 SUBMITTALS
   A. Product Data: For each type of product indicated.
   B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
   C. Preconstruction test reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing film and substrates on which mirrors are installed.
   D. Maintenance data: For mirrors to include maintenance manuals.
   E. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE
   A. Glazing Publications: Comply with GANA's "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
   B. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing and substrates on which mirrors are installed.

1.4 WARRANTY
   A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
      1. Warranty Period: Ten years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors, General: ASTM C 1503.
   
   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. Arch Aluminum & Glass Co., Inc.
      b. Avalon Glass and Mirror Company.
      c. Binswanger Mirror; a division of Vitro America, Inc.
      d. D & W Incorporated
      e. Donisi Mirror Company.
      f. Gardner Glass, Inc.
      g. Gilded Mirrors, Inc.
      h. Guardian Industries.
      i. Head West.
      j. Independent Mirror Industries, Inc.
      k. Lenoir Mirror Company.
      l. Maran-Wurzell Glass & Mirror.
      m. National Glass Industries.
      n. Stroupe Mirror Co., Inc.
      o. Sunshine Mirror; Westshore Glass Corp.
      p. Virginia Mirror Company, Inc.
      q. Walker Glass Co., Ltd.
      r. Washroom Equipment
      s. Bobrick, Inc.
      t. Bradley Corporation

B. Clear Glass: Mirror Glazing Quality.
   
   1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Approved by mirror manufacturer.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.
SECTION 08 83 00

MIRRORS

2.3 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Finish: Clear bright anodized.

B. Mirror Bottom Clips: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


C. Mirror Top Clips: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

E. Anchors and Inserts: Provide devices as required for mirror hardware installation.

2.4 FABRICATION

A. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

B. Mirror Edge Treatment: Flat polished. Seal edges of mirrors with edge sealer.

C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
SECTION 08 83 00

MIRRORS

1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
2. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

B. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

C. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

D. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

E. Protect mirrors from breakage and contaminating substances resulting from construction operations.

F. Do not permit edges of mirrors to be exposed to standing water.

G. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

H. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.
PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes non-load-bearing steel framing members for the following applications:
      1. Interior framing systems.
      2. Interior suspension systems.

1.3 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. Protective Coating: Hot-dip galvanized, 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.
   B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.
   C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25.4 by 4.76 mm) by length indicated.
   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: 1-1/2 inches (38 mm).
   E. Furring Channels (Furring Members):

Luke AFB Shopping Center Image Update
EXCHANGE Project No. 4086-18-000005
May 3, 2019
SECTION 09 22 16

NON-LOAD-BEARING STEEL FRAMING

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. Steel Studs: ASTM C 645.
   a. Minimum Base-Metal Thickness: As indicated on Drawing.
   b. Depth: As indicated on Drawings.
3. 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).

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.0179 inch.
   2. Depth: As indicated in Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:
   1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
   2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (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.

2.4 WALL FURRING CHANNELS

A. 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.

2.5 AUXILIARY MATERIALS

B. 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.
NON-LOAD-BEARING STEEL FRAMING

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

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.

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.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.

6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
SECTION 09 22 16

NON-LOAD-BEARING STEEL FRAMING

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. 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 o.c., unless otherwise indicated.
   b. Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.
   c. Tile backing panels: 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.
   4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
   5. Curved Partitions:
      a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
      b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. 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.
SECTION 09 22 16

NON-LOAD-BEARING STEEL FRAMING

END OF SECTION 09 22 16
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.

B. Related Sections include the following:
   1. Division 9 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
   2. Division 9 Section "Ceramic Tile" for cementitious backer units installed as substrates for ceramic tile.
   3. Division 9 painting Sections for primers applied to gypsum board surfaces.

1.3 SUBMITTALS

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

B. Samples: For the following products:
   1. Textured Finishes: 24" x 24" for each textured finish indicated and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Install mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
SECTION 09 29 00

GYPSUM BOARD

3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 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.

1.6 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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. American Gypsum Co.
   b. BPB America Inc.
   c. G-P Gypsum.
   d. Lafarge North America Inc.
   e. National Gypsum Company.
   f. PABCO Gypsum.
   g. Temple.
   h. USG Corporation.
SECTION 09 29 00

GYPSUM BOARD

B. Type X:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch (15.9 mm), Type X.
   2. Long Edges: Tapered.

2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Building Products; Wonderboard.
      b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      c. USG Corporation; DUROCK Cement Board.
   2. Thickness: 1/2 inch.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. L-Bead: L-shaped; exposed long flange receives joint compound.
      c. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
SECTION 09 29 00

GYPSUM BOARD

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping, all-purpose compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping, all-purpose compound.

4. Finish Coat: For third coat, use setting-type, sandable top, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

D. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

E. Thermal Insulation: As specified in Division 7 Section "Building Insulation."

F. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

2.7 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
SECTION 09 29 00

GYPSUM BOARD

a. G-P Gypsum; Georgia-Pacific Ceiling Textures/Vermiculite.
b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).

2. Texture: Smooth.

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. Type X: As indicated on Drawings.
2. Ceiling Type: As indicated on Drawings.
3. Moisture- and Mold-Resistant Type: As indicated on Drawings.

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.
   b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at showers, and where indicated and locations indicated to receive tile.

B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer’s written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. L-Bead: Use where indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 5: At panel surfaces that will be exposed to view, unless otherwise indicated.

E. Cementitious Backer Units: As indicated on drawings.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer’s written recommendations.

3.8 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
PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Floor Tile
B. Related Sections include the following:
   1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Division 9 Section "Gypsum Board Assemblies" for cementitious backer units.

1.3 SUBMITTALS
A. Tile Samples for Approval and Verification: Manufacturer's samples of actual tiles or sections of tiles showing colors, textures, and patterns for each type and composition of tile indicated in the Construction Documents. Include Samples of accessories involving color selection.
B. Grout Sample for Approval and Verification: Manufacturer's color charts consisting of actual sections of grout for each type of grout indicated in the Construction Documents.
C. Product Data: For each type of product indicated.
D. Product Certificates: For each type of product, signed by product manufacturer.
E. Qualification Data: For Installer.
F. Material Test Reports: For each tile-setting and -grouting product.

1.4 QUALITY ASSURANCE
A. Source Limitations for Tile: Obtain all tile of same type from one source or producer.
   1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
SECTION 09 30 00
CERAMIC TILE

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
   B. 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 complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

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. 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.
         a. Reference drawings for tile materials / description.

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. Floor Tile:
         a. Dal -Tile Corporation
         b. Crossville Ceramic
      2. Tile-Setting and Grouting Materials:
         a. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following manufacturers:
            1) Laticrete International, Inc. Bethany, CT.

2.2 PRODUCTS, GENERAL
SECTION 09 30 00

CERAMIC TILE

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 a manufacturer's standard designations for these characteristics.
2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Mounting: Where factory-mounted tile is required, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.

F. Ceramic Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard. Use full tile bullnose at wainscot cap and behind accessories, typical.

1. Base for Thin-Set Mortar Installations: Coved, square top and round top.
4. Reference Drawings for Manufacturer's product designations and patterns.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.

B. Solid Polymer Thresholds: Made from homogeneous solid sheets of filled plastic resin complying with material and performance requirements in ANSI Z124.3, for Type 5 or Type 6, without precoated finish.

1. Acceptable Product: DuPont Corian Polymers, or Equal.

2.4 SETTING MATERIALS
SECTION 09 30 00

CERAMIC TILE

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:
   1. Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive complying with the following requirements:
      b. 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.


C. Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:
   1. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and liquid-latex additive complying with the following requirements:
      a. Unsanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch (3.2 mm) and narrower (glazed wall tile).
      b. Sanded Dry-Grout Mix: Commercial Portland cement grout complying with ANSI A118.6 for materials described in Section H-2.1, for joints 1/8 inch (3.2 mm) and wider.
      c. Latex Additive: Acrylic resin.

2.5 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

2.6 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. Grout Release formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT
SECTION 09 30 00

CERAMIC TILE

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.

2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. 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, that 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 manufacturers 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 ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION, GENERAL
SECTION 09 30 00

CERAMIC TILE

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.


C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

F. 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. Do not apply grout at intersections where dissimilar materials abut ceramic tile.
3. Install an elastomeric joint compound at locations where dissimilar materials abut ceramic tile.
4. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

G. Grout tile to comply with requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement; dry-set, commercial Portland cement; and latex-Portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

3.4 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
SECTION 09 30 00

CERAMIC TILE

3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

4. Seal grout joints with product recommended by tile manufacturer and install per manufactures recommendations.

B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

D. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

END OF SECTION 09 30 00
PART 1 GENERAL

1.01 WORK INCLUDED
A. Labor and materials necessary to furnish and install ceramic wall tile and base with cementitious grouted joints including all necessary trim and transition shapes for complete installation.

1.02 REFERENCES
B. ANSI A137.1 - Recommended Standard Specifications for Ceramic tile.
C. ANSI A118.1 - Dry-Set Portland Cement Mortar.
D. ANSI A118.4 - Latex-Portland Cement Mortar.

1.03 SUBMITTALS
A. Make submittals in accordance with Section 01300.
B. Submit:
   1. Product data on each type of material to be used.
   2. Sample of tile to be used showing manufacturer's standard range of colors.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Daltile

2.02 TILE
A. Ceramic Wall Tile: TCA 137.1; 3 x 6 x ¼ and 6 x 6 x ¼ glazed semi-gloss.
   1. Colors and patterns: As scheduled on drawings.

2.03 BOND COAT
A. ANSI A118.1, Dry-Set Portland Cement Mortar.
B. ANSI A118.4, Latex Portland Cement Mortar.
C. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A 118.3, with a VOC content of 65 g/L or less when calculated according to 40 CRF 59, Subpart D (EPA Method 24).
2.04 GROUT


B. Commerical Epoxy Grout, 382 Bone.

PART 3 EXECUTION

3.01 Install in accordance with manufacturer's instructions and Trade Association Standards using W243-91, W201-91 and W202-91.

3.02 REPLACEMENT MATERIALS

A. Furnish stock of matching replacement tile, not less than 1% of total amount of wall tile installed, but in no case less than 25 sq. ft., to Owner.

END OF SECTION 09 30 10
SECTION 09 51 13
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS
A. AC: Articulation Class.
B. CAC: Ceiling Attenuation Class.
C. LR: Light-Reflectance coefficient.
D. NRC: Noise Reduction Coefficient.

1.4 QUALITY ASSURANCE
A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.
B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 25.
C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:

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.
SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

B. Before installing acoustical panels, permit them to reach room temperature and 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. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

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.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2.0 percent of quantity installed.

2. Suspension System Components: Quantity of each concealed and exposed grid component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 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.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

2.2 ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING

A. Products: Subject to compliance with requirements, provide the following:

ACT-1: 24” x 48” x 5/8” Eclipse Climaplus, Square Edge, No. 562, White as manufactured by USG Interiors.
ACOUSTICAL PANEL CEILINGS

1. Panels shall have the following characteristics:
   a. NRC: .55
   b. CAC: 35
   c. Light Reflectance: 0.81
   d. Flame Spread: 25 or less.
   e. Smoke Developed: 50 or less.
   f. Recycled content: 50%
   g. Texture: Perforated.
   h. Color: White.
   i. Dimensions as noted on Drawings

B. Products: Subject to compliance with requirements, provide the following:

   ACT-2: 24” x 48” x 5/8” Climaplus, Square Edge, No. 56091, White, Vinyl, Firecode as manufactured by USG Interiors.

   1. Panels shall have the following characteristics:
      a. NRC: N/A
      b. CAC: 35
      c. Light Reflectance: 0.79
      d. Flame Spread: 25 or less.
      e. Smoke Developed: 50 or less.
      f. Recycled content: 55%
      g. Texture: Unperforated
      h. Color: White.
      i. Dimensions as noted on Drawings

C. Products: Subject to compliance with requirements, provide the following:

   ACT-3: 24” x 24” x 5/8” Climaplus, Square Edge, No. 56099, White, Vinyl, Firecode as manufactured by USG Interiors.

   1. Panels shall have the following characteristics:
      a. NRC: N/A
      b. CAC: 35
      c. Light Reflectance: 0.79
      d. Flame Spread: 25 or less.
      e. Smoke Developed: 50 or less.
      f. Recycled content: 55%
      g. Texture: Unperforated
      h. Color: White.
      i. Dimensions as noted on Drawings

D. Products: Subject to compliance with requirements, provide the following:

   ACT-4: 24” x 24” x 5/8” Premier Hi-Lite, Square Edge, No. 7050G, White as manufactured by USG Interiors.

   1. Panels shall have the following characteristics:
SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

a. NRC: .70  
b. CAC: 20  
c. Light Reflectance: 0.79  
d. Flame Spread: 25 or less.  
e. Smoke Developed: 50 or less.  
f. Recycled content: 55%  
g. Texture: Perforated  
h. Color: White.  
i. Dimensions as noted on Drawings

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable 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. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

2. Size: Select wire diameter so its stress at 3 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-diameter wire.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Available Product: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. ACT-1: USG Interiors: Donn DX Grid, White.
2. ACT-2: Donn DXLA Grid, White.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.

C. Edge Moldings and Trim: Provide manufacturer's standard metal molding for edges and penetrations of ceiling which fits with type of edge detail and suspension system indicated.

PART 3 - EXECUTION

3.1 EXAMINATION
SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

A. Examine substrates, areas, and conditions, including structural framing and substrates 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.

1. 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, SUSPENDED ACOUSTICAL PANEL CEILINGS

A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic design 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.
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. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers.

D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Arrange directionally patterned acoustical panels as follows:

1. As indicated on reflected ceiling plans.
3.4 CLEANING

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

END OF SECTION 09 51 13
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Resilient base.

B. Related Sections include the following:
   1. Division 9 Section "Carpet Tile" for carpet tile.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

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).

1.6 PROJECT CONDITIONS

A. Maintain ambient 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 resilient products during the following time periods:

   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.
SECTION 09 65 13

RESILIENT WALL BASE AND ACCESSORIES

B. Until Substantial Completion, maintain ambient 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. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet 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 RESILIENT BASE

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. 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. Johnsonite
   b. Armstrong World Industries, Inc.
   c. Flexco, Inc.
   d. Mondo Rubber International, Inc.
   e. Roppe Corporation, USA.


1. Material Requirement: Type TS (rubber, vulcanized thermoset).
3. Style: Cove (base with toe) and Straight (toeless).

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm) and 6" (153 mm), as indicated on Drawings.

E. Lengths: Cut lengths, 48 inches (1219 mm) long.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As scheduled on drawings.
SECTION 09 65 13

RESILIENT WALL BASE AND ACCESSORIES

2.2 ACCESSORIES


B. Adhesives: Water-resistant type recommended by manufacturer for substrate and conditions indicated.


D. Transition Strips: As necessary between different flooring materials per manufacturer's recommendations.

E. Lengths: Coils in manufacturer's standard length or coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

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

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Cove Base Adhesives: Not more than 50 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. 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.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
SECTION 09 65 13

RESILIENT WALL BASE AND ACCESSORIES

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. 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.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 09 65 13
PART 1 - GENERAL

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

1.02 SUMMARY
   A. This Section includes the following:
      1. Vinyl composition tile (VT).
      2. Recycled rubber tile.
      3. Rubber tile.
   B. Related Sections include the following:
      1. Division 9 Section 09653 "Resilient Wall Base and Accessories".

1.03 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.

1.04 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.

1.05 PERFORMANCE REQUIREMENTS
   A. Floor Score Compliance: Resilient floor tile shall comply with requirements of Floor Score standard.

1.06 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.

1.07 PROJECT CONDITIONS
SECTION 09 65 19

RESILIENT TILE FLOORING

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.

1.08 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

2.01 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.

2.02 VINYL COMPOSITION TILE (VT)

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:
SECTION 09 65 19

RESILIENT TILE FLOORING

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

2.03 RECYCLED RUBBER TILE (RT)

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:

2.04 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.

2.05 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.

C. 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

3.01 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.

3.02 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.

3.03 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.

3.04 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.

3.05 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.
SECTION 09 65 19

RESILIENT TILE FLOORING

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 09 65 19
SECTION 09 68 13
CARPET

PART 1 GENERAL

1.01 THIS SECTION INCLUDES

A. Carpet flooring as shown on the drawings and schedules and as indicated by the requirements of this section.

1.02 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract (including General and Supplementary Conditions and Division 1 sections) apply to the work in this section only.

1.03 RELATED SECTIONS

A. Other Division 9 sections for floor finishes related to this section but not the work of this section.

B. Division 3 Concrete - not included work this section.

C. Division 6 Wood and Plastics - not included work this section.

D. Division 7 Thermal and Moisture Protection - not included work this section.

1.04 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

A. Qualifications of Installers: All work shall be done by installation firms specializing in commercial carpet installation. It is required, that the firm or individual shall be a member of the Floor Covering Installation Contractors Association (FCICA) and/or certified by the Certified Floorcovering Installers Association (CFI). Flooring contractor to be specialty contractor normally engaged in this type of work and shall have three (3) years minimum documented experience in commercial installation of these materials and participation in manufacturer’s environmental program including responsible carpet removal, recycling, and installation.

B. Flooring contractor will be responsible for the proper product installation, including floor preparation in all the areas indicated in the drawings to receive carpet. The carpet installation standard will be as listed in The Carpet and Rug Institute’s Standard for Installation of Commercial Carpet CRI-104, the standard that establishes the minimum installation procedures.

C. Flooring contractor to provide owner a written warranty that guarantees the completed installation to be free from defects in materials and workmanship for a period of no less than two (2) years after job completion.

D. All warranties must be issued by the manufacturer as standard published warranties on all types of carpet within this document. Second source warranties that involve parties other than the carpet manufacturer are unacceptable. If the product fails to perform as warranted when installed according to the J&J Industries carpet installation handbook and maintained
according to J&J Industries maintenance instructions, the affected area will be repaired or replaced at the expense of the manufacturer. The carpet manufacturer will provide standard published written performance warranties for the following:

1. Lifetime warranty against excessive surface wear. Excessive wear means no more than 10% loss of pile fiber weight measured before and after use as tested under ASTM D-3936.

2. Lifetime static protection, meaning built-in protection below 3.0 kv as tested under AATCC-134.

3. Tuft Bind (edge ravel, yarn pulls, zippering)

4. Delamination

5. Lifetime Moisture Barrier (excluding Premier Bac)

6. Lifetime Dimensional Stability (for modular products only)

E. Carpet manufacturer to provide field service experts to assist in project start-up as required by the job. Manufacturer will notify owner, architect, general contractor, or another designated contact if any installation instructions are not followed.

F. Provide flooring material to meet the following test performance criteria as tested by a recognized independent testing laboratory. Certified test reports shall be submitted by the carpet manufacturer for each test method. Requirements listed below must be met by all products being submitted for approval:

1. Pill Test / DOC-FF-1-70 (ASTM D-2589) - Requirement: Pass

2. Flooring Radiant Panel / ASTM E-648 - Requirement: Class I (Above .45 w/cm)

3. CRI VOC Chamber Test/Indoor Air Quality test (CRI-IAQ) Green Label Plus Test.

4. Lightfastness: Rating of not less than 5 on International Grey Scale after 40 SFU's when tested in accordance with AATCC Test Method 16E.

5. Crockfastness: Minimum stain rating on International Grey Scale of not less than 5 wet or dry when tested in accordance with AATCC Test Method 165.

6. Atmospheric Fading: Burned Gas shall not be less than 5 on International Grey Scale after two cycles on each test as per AATCC Test Method 129 Ozone and AATCC Test Method 23.

1.05 SUBMITTALS

A. Submit to architect and/or owner ten (10) days prior to bid, two (2) 12" x 12" finished samples of the exact type of carpet proposed, including quality, pattern, color, and backing.

B. Submit to architect and/or owner ten (10) days before bid, any proposed substitutions for consideration. Submit at least three (3) references of installations, that have been in use for two (2) years or more using the same backing technology of all carpets, as described within this text. Include contact names and telephone numbers.
C. Submit manufacturer's warranties, installation instructions, and maintenance instructions before bid date.

D. Submit the manufacturer's certification that the flooring has been tested by an independent laboratory and complies with the required fire tests as well as the test listed under 1.04 F.

1.06 ENVIRONMENTAL/FIELD CONDITIONS

A. Deliver all materials to the installation site in the manufacturer's original packaging and in good condition. Packaging to contain manufacturer's name and marks, identification number, shipping and handling instructions and related information.

B. Delivered and stored materials must be available for inspection as required by the owner, architect, general contractor, and/or the manufacturer.

C. Sub-floor preparation is to include all required work to prepare the existing floor for installation of the product as specified in this document. Sub-floor preparation shall meet all conditions as specified in J&J Industries’ installation handbook instructions.

D. Sub-floor preparation will include, as required, the removal and repair of the existing floor surface. It is required that the floor of a renovation project be inspected before the bid date.

E. All materials, including adhesives, are to be delivered to the site of installation at a minimum of 48 hours prior to the start of installation and stored in a clean and dry room that measures above 65°F and below 95°F and measures between 10% and 65% relative humidity (RH). To maintain temperature and relative humidity, permanent heating and air conditioning systems (HVAC) must be in operation. Stack rolls horizontally and no higher than two rolls high on a flat surface. After work is completed, the ambient room temperature should remain at 65°F and relative humidity between 10% and 65% for 48 hours. These materials and related adhesives shall be protected from the direct flow of heat from heating fixtures and appliances such as hot-air registers, radiators, or other. Site conditions shall include those specified in the carpet manufacturer’s installation manual and shall also include sufficient heat, light, and power required for effective and efficient working condition.

F. Once the temperature and relative humidity in area for installation have been stabilized, loose lay the carpet within the installation area and allow it to precondition for 48 hours prior to installation. Carpet installation shall not commence until painting and finishing work is complete and ceiling and overhead work is tested, approved, and completed. Traffic shall be closed during the installation of the flooring products. Verify concrete slabs are dry per the standards for bond and moisture tests listed in the manufacturer’s installation manual.

1.07 SUBSTITUTIONS

A. All Bid submittals must conform to the specifications in this document.

B. All test results to be in accordance with a certified independent testing laboratory.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:

2. Any manufacturer and/or product must meet or exceed those requirements specified under all sections of this document in pattern, color, and fiber. Any substitutions must be made in accordance with Section 00110 - Instructions to Bidders of this document.

2.02 FLOORING MATERIALS

A. Carpet Tile Type 1:

2. Color: Pyrite 338 and Basalt 324
3. Construction: Textured patterned loop
4. Backing: Nexus® modular
5. Dye Method: Piece dyed
6. Fiber Type: 100% Nylon
7. Face Weight: 35oz./sy (118.67 grams/m2)
8. Pile Density: 8,400 oz./sy (296.64 kg/m3)
9. Gauge: 1/12 (4.72 rows/cm)
10. Stitches: 11.0 stitches/in (4.33 stitches/cm)
11. Pattern Repeat: N/A
12. Soil Release: No
13. Stain / Bleach Resistance: No
14. Optional Treatments: No
15. Standard Size: 24X24
16. Warranties: Lifetime fiber performance for wear, Lifetime for tuft bind strength (edge ravel, yarn pulls, zipper), Lifetime protection from delamination failure, Lifetime fiber performance for static, Lifetime colorfastness to atmospheric contaminants, Lifetime stain removal
17. Testing Specifications - Pill Test: Yes
18. Testing Specifications - Flooring Radiant Panel: Class 1
19. Testing Specifications - Smoke Density: Less than 450 flaming (ASTM E 662)
20. Testing Specifications - Static Test: Less than 3 kv (AATCC-134)

21. Testing Specifications - Lightfastness Test: Yes

2.03 ADHESIVES

A. Commercialon® Premium Modular Pressure Sensitive Adhesive, a premium flooring adhesive designed for all commercial carpet backing with the exception of vinyl backed carpet, PVC, tile or sheet vinyl, is required for use with Nexus® Modular products.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated.
   1. VOC limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.04 ACCESSORIES

A. Provide transition/reducing strips tapered to meet abutting materials as indicated in the drawings.

B. Provide edge strips made of extruded aluminum with a mill finish, unless otherwise noted.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine and verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are dry enough and ready for flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by carpet manufacturer and adhesive materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

F. J+J/Industries requires that the carpet be inspected prior to installation for proper style, color and potential defects. No claims will be honored if the carpet is installed with visible defects. Should there be a problem, call 800.241.4586, ext. 8210.

3.02 PREPARATION

A. Starting installation constitutes acceptance of sub-floor conditions.
B. SURFACE PREPARATION- Dust, dirt, debris and noncompatible adhesive must be removed before the installation begins. Surfaces must be smooth and level with all holes and cracks filled with Portland cement-based patch reinforced with polymers or primed with TriSeal Sealer.

C. CONCRETE MOISTURE TESTING and pH Testing - Substrate surfaces must be tested for moisture emission. It is the responsibility of the owner or owner’s representative to perform moisture testing prior to starting the installation. ASTM-F2170-2 relative humidity probe moisture testing or ASTM-F1869 calcium chloride testing can be performed on the concrete to determine the surface moisture emission rate. Acceptable relative humidity probe testing results are up to 75% RH. An acceptable result for calcium chloride moisture testing is up to 5 lbs per 1,000 SF per 24 hours. Alkalinity tests should also be performed per ASTM-F710. The maximum acceptable pH is 9.0. J+J/Invision prefers relative humidity probe moisture testing over calcium chloride testing, as the results are more accurate and reliable. For test results that determine RH test readings of 75% - 85%, moisture emission rates of 5 lbs – 8 lbs, or pH readings of 9.0 – 11.00, XL Brands DriSeal Concrete Moisture Sealer is required. NOTE: When both XL Brands TriSeal Sealer and DriSeal Concrete Moisture Sealer are required, TriSeal is applied prior to DriSeal.

D. New Concrete – New concrete must be fully cured and free of moisture. New concrete requires a curing period of approximately 90 days.

3.03 INSTALLATION OF FLOORING

A. Install flooring in strict accordance with the finish drawings, manufacturer's instructions, and CRI Carpet Installation Standard. Install carpet tile in accordance with manufacturer's instructions and CRI 104.

B. FULL SPREAD ADHESIVE SYSTEM- J&J Industries requires a full spread adhesive system for installation of Nexus Modular (carpet tile). Fully spread Commercialon® Premium Modular Pressure Sensitive Adhesive using a 1/32 x 1/16 x 1/16 "U" or "V" notch trowel or spread using a 3/8" foam paint roller. Keep the roller saturated and wet with adhesive throughout the installation in order to maintain a constant spread rate. Allow to completely dry so adhesive does not transfer when touched. The spread rate for Commercialon Premium Modular Adhesive is approximately 140 sq. yds. per four gallon bucket. Nexus® Modular Spray Adhesive is available in a 14 lbs cylinder (coverage is approx. 165 sq yds). Note: Inadequate amounts of adhesive can cause modules to shift and move and will not be covered under warranty. Warranty coverage requires the use of Commercialon Premium Modular Adhesive. J&J Industries will not be responsible for the adhesive bond where other adhesives have been used.

C. TILE PLACEMENT - Arrows are embossed or printed on the module backing to show pile direction. To ensure proper alignment, check spacing every ten modules. Measure ten modules; proper spacing should be within ¼ inch. Continue to check spacing every ten modules throughout the entire installation.

D. PALLET AND BUNDLE SEQUENCING - It is very important to install J+J/Industries modules in the order they were manufactured; this is easily accomplished by selecting pallets in sequential order and following the numbers located on each bundle. Typically, an installation will begin with the lowest bundle numbers and progress through the highest numbers until the project is complete. Installing modules by bundle sequence will assure the most even uniform look possible. (For layout and installation instructions refer to J+J/Invision Carpet Installation Handbook or CRI 104 Standards.)

E. FINISHED INSTALLATION- Roll entire job with 75-100 lb. roller after completion of installation.
3.04 INSTALLATION OF ACCESSORIES

A. Install accessories as required by drawings and per manufacturer’s specifications.

3.05 CLEANING AND PROTECTION

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

C. LOOP PILE CONSTRUCTION--Carpet modules with loop pile constructions may experience yarn blossoming at the edges, which is consistent with this type of construction. Clipping or shearing the yarn edges can remedy this condition.

END OF SECTION 09 68 13
SECTION 09 72 00
VINYL WALL COVERING

PART 1  GENERAL

1.01  WORK INCLUDED
A. Prepare surfaces to receive wall covering.
B. Adhesive applied on wall covering.

1.02  SUBMITTALS
A. Submit manufacturer's installation instructions under provisions of the General Provisions.
B. Submit (two) 12 inch x 12 inch size samples of wall covering of each color for approval of Contracting Officer indicating quality, color, texture and weight.
C. Submit Product Data for Credit EQ4.1: For adhesives, including printed statement of VOC content and chemical components.

1.03  STORAGE AND HANDLING
A. Store wall covering in clean and dry area. Do not store in upright position.
B. Take precautionary measures to prevent fire hazards with adhesives and solvents.
C. Where toxic materials and both toxic and explosive solvents and adhesives are used, appropriate precautions and proper ventilation must be provided.

1.04  ENVIRONMENTAL REQUIREMENTS
A. Maintain surfaces and materials at minimum 60 degrees F. (16 degrees C) three days before and during application.
B. Ensure maximum surface moisture conforms to wall covering manufacturer's requirements and surface exhibits negative alkalinity.
C. Provide adequate and continuous ventilation during work and after installation of wall covering.

1.05  MAINTENANCE DATA
A. Provide Owner with maintenance instructions. Instructions to contain manufacturer's recommended cleaning materials and application methods, including precautions in use of cleaning materials which may be detrimental to surfaces if improperly applied.
B. Instructions to contain manufacturer's recommended cleaning materials and application methods, including precautions in use of cleaning materials which may be detrimental to surfaces if improperly applied.

PART 2  PRODUCTS
SECTION 09 72 00
VINYL WALL COVERING

2.01 MATERIALS

A. Vinyl Coated Fabric Wall Covering: AF/Cl or AF/AI, See drawings for location.

B. Adhesive: Type recommended by wall covering manufacturer to suit application including primer/sealer.
   1. Adhesive: Mildew-resistant, nonstaining, strippable, adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall-covering manufacturer, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 590, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 INSPECTION

A. Ensure surfaces to receive wall covering are clean, true, and free of irregularities. Inspect surfaces before commencing work and report defects in writing.

B. Ensure wall surface flatness tolerance do not vary more than 1/8" in 10’ nor vary at a rate greater than 1/16" per running foot.

C. Schedule installation of wall covering as late as possible to prevent damage during construction and movement of materials.

3.02 PREPARATION

A. Fill nicks, gouges and other minor imperfections of gypsum board surfaces with latex filler. Sand smooth and flush with surface. Follow with prime coat or sealer recommended by wall covering manufacturer.

B. Wash down painted surfaces with tri-sodium phosphate, rinse with clear water. Open up glossy surfaces with rough sandpaper for bond, then seal. Remove bleeding paint, flaky paint, or wood stain. Prime surfaces to receive latex paints with one full coat of oil base sealer.

C. Remove rust, dirt, grease and other minor imperfections of plywood surfaces with patching plastic. Follow with coat of alkyd flat or oil base sealer.

D. Fill in nicks, gouges and other minor imperfections of plywood surfaces with patching plastic. Follow with coat of alkyd flat or oil base sealer.

3.03 APPLICATION

A. Handle and apply wall covering and adhesive in accordance with manufacturer's instructions.

B. Mix and apply adhesive in accordance with adhesive manufacturer's instructions.

C. Use fabric panels in exact order as cut from rolls. Use rolls in consecutive order as numbered by manufacturer.

D. Trim deeply textured patterns or where patterns must be matched, on a flat work table.
SECTION 09 72 00
VINYL WALL COVERING

E. Hang smooth, non-match patterns by applying strips on the wall, overlapping the edges, and double cutting through both thicknesses.

F. Apply fabric secure, smooth, clean and without wrinkles, gasp, or overlaps. Eliminate air pockets and ensure full bond to wall surface.

G. Horizontal seams and cutting at corners are not acceptable. Cutting to be not less than 2-inches of an inside corner and not less than 6-inches of an outside corner.

H. Remove excess adhesive from each seam before proceeding to next. Wipe seam clean with dry cloth towel.

I. Remove excess adhesive from each seam before proceeding to next. Wipe seam clean with dry cloth towel.

J. Install wall covering before installation of bases, hardware, etc.

3.04 CLEANING

A. Clean wall coverings of adhesives, dust, dirt and other contaminants.

B. Remove debris and leave areas neat and clean.

C. Replace wall plates and accessories.

END OF SECTION 09 72 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel.
2. Galvanized metal.
3. Wood.

B. Related Sections include the following:

1. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
2. Division 6 Sections for shop priming carpentry with primers specified in this Section.
3. Division 9 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
4. Division 9 Section "Wood Stains and Transparent Finishes" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.3 SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
SECTION 09 90 12

INTERIOR PAINTING

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

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. Dunn-Edwards Corporation.
2. Benjamin Moore & Co.
3. Frazee Paint.
4. ICI Paints.
5. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. 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:
SECTION 09 90 12

INTERIOR PAINTING

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. 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.
   o. Hexavalent chromium.
   p. Isophorone.
   q. Lead.
   r. Mercury.
   s. Methyl ethyl ketone.
   t. Methyl isobutyl ketone.
   u. Methylene chloride.
   v. Naphthalene.
   w. Toluene (methylbenzene).
   x. 1,1,1-trichloroethane.
   y. Vinyl chloride.

C. Colors: As selected by Architect from manufacturer's full range.

2.3 BLOCK FILLERS

   1. VOC Content: E Range of E2.

2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.
   1. VOC Content: E Range of E2.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS
SECTION 09 90 12

INTERIOR PAINTING

A. Alkyd Anticorrosive Metal Primer: MPI #79.
   1. VOC Content: E Range of E2.

B. Quick-Drying Alkyd Metal Primer: MPI #76.
   1. VOC Content: E Range of E2.

   1. VOC Content: E Range of E1.

2.6 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.
   1. VOC Content: E Range of E2.

2.7 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).
   1. VOC Content: E Range of E2.

B. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).
   1. VOC Content: E Range of E2.

C. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).
   1. VOC Content: E Range of E2.

D. Interior Latex (Satin): MPI #43 (Gloss Level 4).
   1. VOC Content: E Range of E2.

E. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).
   1. VOC Content: E Range of E2.

F. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).
   1. VOC Content: E Range of E2.

2.8 ALKYD PAINTS

A. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).
   1. VOC Content: E Range of E2.
SECTION 09 90 12
INTERIOR PAINTING

B. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).
   1. VOC Content: E Range of E2.

C. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).
   1. VOC Content: E Range of E2.

D. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).
   1. VOC Content: E Range of E2.

2.9 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).
   1. VOC Content: E Range of E2.

B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).

2.10 VOC Content: E Range of E2. EPOXY COATINGS

A. Epoxy, Cold-Cured, Gloss: MPI #77.
   1. VOC Content: Minimum E Range of E1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

   1. Wood: 15 percent.
   2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.
SECTION 09 90 12
INTERIOR PAINTING

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

H. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
SECTION 09 90 12
INTERIOR PAINTING

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:
   a. Uninsulated metal piping.
   b. Uninsulated plastic piping.
   c. Pipe hangers and supports.
   d. Tanks that do not have factory-applied final finishes.
   e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
   f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
   g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:
   a. Switchgear.
   b. Panelboards.
   c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.

2. Testing agency will perform tests for compliance with product requirements.

3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION
SECTION 09 90 12
INTERIOR PAINTING

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

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:
   1. Quick-Drying Enamel System: MPI INT 5.1A.
      c. Topcoat: Quick-drying enamel (semigloss).
   2. Alkyd System: MPI INT 5.1E.
      c. Topcoat: Interior alkyd (semigloss).

B. Galvanized-Metal Substrates:
   1. Alkyd System: MPI INT 5.3C.
      c. Topcoat: Interior alkyd (eggshell).

C. Gypsum Board Substrates:
   1. Latex System: MPI INT 9.2A.
      c. Topcoat: Interior latex (eggshell).
SECTION 09 90 12

INTERIOR PAINTING

a. Prime Coat: Interior latex primer/sealer, MPI #50.
b. Intermediate Coat: Epoxy, cold-cured, gloss, MPI #77.
c. Topcoat: Epoxy, cold-cured, gloss, MPI #77.

D. Painted Woodwork:

a. 1st Coat - Enamel undercoat.
b. 2nd Coat - Semi-gloss enamel.
c. 3rd Coat - Semi-gloss enamel.

E. Concrete Floors (Exposed) - MPA, Storage Areas, Utility Room:

a. 2 coats Sonothane polyurethane sealer.

END OF SECTION 09 90 12
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes surface preparation and the application of wood finishes on the following substrates:

1. Interior Substrates:
   a. Dressed lumber (finish carpentry).

B. Related Sections include the following:

1. Division 9 Section "Interior Painting" for surface preparation and application of standard paint systems on interior substrates.

1.3 SUBMITTALS

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

B. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

1. Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.
2. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of MPI's current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.

1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply exterior finishes in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

   1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Material Compatibility:

   1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

   2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

B. Stain Colors: As selected by Architect from manufacturer's full range.

2.2 WOOD FILLERS

A. Wood Filler Paste: MPI #91.
SECTION 09 90 31

WOOD STAINS AND TRANSPARENT FINISHES

1. VOC Content: E Range of E2.

2.3 PRIMERS AND SEALERS
   A. Wood Preservative: MPI #37.
      1. VOC Content: E Range of E3.

2.4 STAINS
   A. Interior Wood Stain (Semi-transparent): MPI #90.
      1. VOC Content: E Range of E2.

2.5 POLYURETHANE FINISHES
   A. Two-Component Aliphatic Polyurethane (Clear): MPI #78.
      1. VOC Content: E Range of E2.
   B. Interior, Oil-Modified, Clear Urethane (Satin): MPI #57, Gloss Level 4.
      1. VOC Content: E Range of E2.
   C. Interior, Oil-Modified, Clear Urethane (Gloss): MPI #56, Gloss Level 6.
      1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine substrates and conditions, with Applicator present, for compliance with requirements
      for maximum moisture content and other conditions affecting performance of work.
      1. Maximum Moisture Content of Wood Substrates: 15 percent when measured with an
         electronic moisture meter.
      2. Verify compatibility with and suitability of substrates, including compatibility with existing
         finishes.
      3. Begin finish application only after unsatisfactory conditions have been corrected and
         surfaces are dry.
      4. Beginning application of finish system constitutes Contractor’s acceptance of substrate
         and conditions.

3.2 PREPARATION
WOOD STAINS AND TRANSPARENT FINISHES

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
   1. After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
   2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
   3. Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.

D. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions.
   1. Use applicators and techniques suited for finish and substrate indicated.
   2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 FIELD QUALITY CONTROL

A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when finishes are being applied:
   1. Owner will engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes are incompatible.
3.5 CLEANING AND PROTECTION

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

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

3.6 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

E. Finish Carpentry Substrates:

1. Polyurethane Varnish System: MPI INT 6.3K.
   b. Two Field-Applied Finish Coats: Interior, oil-modified, clear urethane (satin).
SECTION 09 97 00
SLATWALL

PART 1 GENERAL

1.01 DESCRIPTION OF WORK
A. Labor and materials required to furnish and install complete slatwall.

1.02 SUBMITTALS
A. Make submittals in accordance with Substitution Procedures 01 33 00.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Viewrite.

2.02 MODEL NUMBER
A. Slat wall slotted wall panels 8’ x 4’ x 3/4”, 3” o.c. with clear aluminum extruded inserts, laminate face.
B. Trim: 3” x 96” end caps and outside corners.
C. Color: As scheduled on drawings.

PART 3 EXECUTION

3.01 INSTALLATION
A. Install in accordance with manufacturer’s instructions.

END OF SECTION 09 97 00
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Dimensional characters.
   2. Panel signs.


1.3 SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide message list, typestyles, graphic elements, and layout for each sign.

C. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
   1. Dimensional Characters: Full-size Samples of each type of dimensional character (letter, number, and graphic element).
   2. Aluminum: For each form, finish, and color, on 6-inch- (150-mm-) long sections of extrusions and squares of sheet at least 4 by 4 inches (100 by 100 mm).
   3. Acrylic Sheet: 8 by 10 inches (200 by 250 mm) for each color required.

D. Maintenance Data: For signs to include in maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE
SIGNAGE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.


D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit installation of signs in exterior locations to be performed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

A. Coordinate placement of anchorage devices with templates for installing signs.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   
   a. Deterioration of metal finishes beyond normal weathering.
   b. Deterioration of embedded graphic image colors.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).
SECTION 10 14 00

SIGNAGE

B. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications.

2.2 PANEL SIGNS

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. ASI-Modulex, Inc.
2. Best Sign Systems Inc.

B. Exterior and Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner, complying with the following requirements:

1. Acrylic Sheet: Match existing signage.
2. Edge Condition: Square cut.
3. Corner Condition: Square.
4. Mounting: Unframed
   a. Wall mounted with concealed anchors two-face tape.
   b. Manufacturer's standard anchors for substrates encountered.
5. Color: Match existing signage.
6. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch (0.8 mm) above surface with contrasting colors.

C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

D. 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: _______.

E. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.

F. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
SECTION 10 14 00

SIGNAGE

1. Color: Match existing signage.

G. Panel Sign Schedule (Verify with Owner exact name of each room):

1. Sign Type:
   a. DENTAL CLINIC (50A)
   b. OFFICE (51A)
   c. MANAGER (52A)
   d. PAN X-RAY (56.8A)
   e. BREAKROOM (56.9A)
   f. STORAGE (56.10A)
   g. OPERATORY (55A, 55B)
   h. LAB (56.1A)
   i. STERIL (56.4A)
   j. TOILET (56.7A)

2.3 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.4 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. 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. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin mechanical finish, complying with AAMA 611.

2.9 OTHER METAL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

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 work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

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

3.2 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.

1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.

C. Dimensional Characters: Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and
SECTION 10 14 00

SIGNAGE

condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.

1. Projected Mounting: Mount characters at projection distance from wall surface indicated.

3.3 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer’s written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00
PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes solid plastic units as follows:
      1. Toilet Enclosures: Floor and ceiling anchored.
   B. Related Sections include the following:
      1. Division 5 Section "Metal Fabrications" for supports that attach floor-and-ceiling-anchored units to overhead structural system.
      2. Division 10 "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 SUBMITTALS
   A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
      1. Show locations of cutouts for compartment-mounted toilet accessories.

1.4 QUALITY ASSURANCE

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

PART 2 - PRODUCTS
2.1 SOLID-POLYMER UNITS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Scranton Products

B. Door, Panel, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
   1. Color and Texture: Classic Color Collection, Orange Peel and color Charcoal Grey.

C. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

D. Brackets (Fittings):
   1. Full-Height (Continuous) Type: Manufacturer's standard design; polymer or extruded aluminum.

2.2 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear anodized aluminum.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

A. Floor-and-Ceiling-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with leveling adjustment at tops and bottoms of pilasters. Provide shoes and sleeves (caps) at pilasters to conceal anchorage.

B. 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 accessible to people with disabilities.
   1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees.
   2. Latch and Keeper: Manufacturer's standard recessed latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that
SECTION 10 21 13

TOILET COMPARTMENTS

comply with accessibility requirements of authorities having jurisdiction at compartments indicated to be accessible to people with disabilities.

3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.

4. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

5. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

   a. Pilasters and Panels: 1/2 inch (13 mm).
   b. Panels and Walls: 1 inch (25 mm).

B. Floor-and-Ceiling-Anchored Units: Secure pilasters to supporting construction and level, plumb, and tighten. Hang doors and adjust so doors are level and aligned with panels when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13
PART 1 - GENERAL

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

1.2 SUMMARY
   A. This Section includes the following:
      1. Corner guards.

1.3 SUBMITTALS
   A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall-protection unit.
   B. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE
   A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
   B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
   C. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.
   D. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
      1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.5 PROJECT CONDITIONS
   A. Environmental Limitations: Do not deliver or install impact-resistant wall-protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.
B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with impact-resistant wall-protection units by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of impact-resistant wall-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

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.

B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CORNER GUARDS

A. Provide Acrovyn 4000 Model SN-20N, 3” wide with ¼” radius. Finish 378 Bushed Nickel. 4’-0” long.

2.3 CHAIR RAIL


2.4 CART BUMPER RAIL

A. Provide McCue Corporation CartStop BR floor mount rail.
SECTION 10 26 00

IMPACT-RESISTANT WALL PROTECTION

2.5 FABRICATION

B. Fabricate impact-resistant wall-protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

C. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

D. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 METAL FINISHES

E. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

1. Remove tool and die marks and stretch lines or blend into finish.
2. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

F. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

G. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

2. For impact-resistant wall-protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall-protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.
SECTION 10 26 00

IMPACT-RESISTANT WALL PROTECTION

3.3 INSTALLATION

A. General: Install impact-resistant wall-protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

   a. Provide anchoring devices to withstand imposed loads.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00
SECTION 10 28 13
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

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

1.2 SUMMARY
A. This Section includes the following:
   1. Public-use washroom accessories.
   2. Private-use bathroom accessories.
   3. Underlavatory guards.
B. Owner-Furnished Material: To be verified with Owner
C. Related Sections include the following:
   1. Division 8 Section "Mirrors" for frameless mirrors.
   2. Division 9 Section "Ceramic Tile" for ceramic toilet and bath accessories.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

1.4 QUALITY ASSURANCE
A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.5 COORDINATION
A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
TOILET AND BATH ACCESSORIES

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.6 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16 (ASTM B 16M), rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch (0.9-mm) minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.


F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.


2.2 WASHROOM ACCESSORIES

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. Bobrick Washroom Equipment, Inc.
2. Cweco.
3. Perrincraft.

B. Paper Towel Dispenser: Provide Georgia Pacific #59462 EnMotion Wall Mount Automated Touchless Towel Dispenser.
TOILET AND BATH ACCESSORIES


D. Toilet Tissue Dispenser: Provide Georgia Pacific #56790, compact vertical double roll coreless tissue dispenser.

E. Soap Dispenser: Provide Eco Lab Kay touch free dispenser.

F. Mirrors: Provide stainless steel, one-piece channel frame mirror with bright polished finish, mitered corners and Bobrick No. B-290, 48" high x full counter width, B-290 x 1872 and B-290 x 1836.

G. Grab Bars: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area. Configuration and Length: As indicated on Drawings. Bobrick B-6806 x 36".

H. Shelf with Mop and Broom Holders and Rag Hooks: Provide 36" long, satin finish stainless steel unit with four holders and three hooks, Bobrick B-223.

I. Diaper Changing Station: Provide KB200-05, white granite color, horizontal surface mounted unit with bed liner dispenser, Koala Corp.


K. Child Protection Seat: Provide KB102-00, creame color, surface mounted unit as manufactured by Koala Corp.


2.6 FABRICATION

M. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

N. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.
SECTION 10 28 13

TOILET AND BATH ACCESSORIES

3.2 ADJUSTING AND CLEANING

   A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

   B. Remove temporary labels and protective coatings.

   C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 13
SECTION 21 00 00
FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide all material, labor, equipment, design and services necessary to perform the installation of the fire sprinkler system as shown on the drawings and as described herein.

B. Summary of Work: This installation will consist of hydraulically calculated wet pipe sprinkler systems protecting the entire building.

C. Design densities shall be in accordance with NFPA 13 and the following:
   1. Mechanical rooms, storage rooms, and similar areas shall be designed for an ordinary hazard group 1 density.
   2. All other areas shall be designed in accordance with NFPA 13.

1.2 QUALITY ASSURANCE

A. Codes and Standards: This installation shall conform to each of the following:
   1. Unified Facilities Criteria (UFC) 3-600-01
   2. FM Global Data Sheets
   3. NFPA 13
   4. Base Installation Design Standards

B. All work shall comply fully with all applicable codes and standards. Nothing in the contract documents shall be construed to permit non-compliance with any code or standard.

C. Warrantee: The contractor shall guarantee all materials, equipment and workmanship in this installation for a period of one year from the date of completion. Any system failure during that time shall be repaired at the contractor's expense. Contractor shall respond on site to system problems within 24 hours.

D. Qualifications of Contractor: All work shall be performed by a Contractor with a valid State Contractor's license for the installation of fire sprinkler systems.

E. The field installation shall be supervised at all times by a journeyman sprinkler fitter or person with equivalent experience.

F. Approval by the Authority Having Jurisdiction: For purposes of code compliance the Authority Having Jurisdiction (AHJ) for this installation will be Base Installation Department of Public Works. Where there are conflicts between the AHJ and the referenced codes and standards, the more stringent shall apply.

1.3 SUBMITTALS

A. Material Submittals: At least 10 working days prior to submitting shop drawings, furnish to the A/E a complete list of equipment and products, and a manufacturer's catalog sheet for each item to be included in the project. The Contractor may submit as many copies as it practically needs. Three copies will be retained, the remainder will be returned to the contractor. Each copy shall be bound separately in a soft cover three-hole folder, and shall include an index of all items in the submittal.
B. All material submittals shall include all items listed in the product section of this specification and all additional items necessary to provide a complete installation. Where more than one item appears on a manufacturer's catalog sheet, the item or items to be used shall be indicated.

C. Shop Drawings: At least 15 working days prior to any installation or fabrication of the system components, the Contractor shall submit two sets of shop drawings and hydraulic calculations to the A/E for review by the A/E. The A/E will review the submittals and make any pertinent comments, returning one set to the contractor. The contractor will then make any necessary corrections and submit six sets for approval. Two sets of each will be retained by the A/E. Submit additional sets as desired for return to the contractor.

D. Shop drawings shall conform to, and include all items as set forth in NFPA 13.
1. After approval is received from the A/E, submit shop drawings to the AHJ for approval. Submit evidence of final drawing approval by the AHJ to the A/E prior to the start of fabrication or installation.

1.4 DRAWINGS OF RECORD

A. Updating Drawings: Provide and keep up to date, a complete record set of approved shop drawings, corrected daily to show every change from the approved shop drawings. Keep this set of prints on the job site and use only as a record set.

1.5 QUALIFICATIONS

A. Supervisor
1. NICET Fire Alarm Technicians to perform the installation of the system. A NICET Level 4 Fire Alarm Technician shall supervise the installation of the fire alarm system/mass notification system. The Fire Alarm technicians supervising the installation of equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

B. Technician
1. Fire Alarm Technicians with a minimum of four years of experience utilized to install and terminate fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians installing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

C. Installer
1. NICET Level II technician to assist in the installation of fire alarm/mass notification devices, cabinets and panels. An electrician shall be allowed to install wire, cable, conduit and back boxes for the fire alarm system/mass notification system. The Fire Alarm installer shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

D. Test Personnel
1. Fire Alarm Technicians with a minimum of eight years of experience (NICET Level IV) utilized to test and certify the installation of the fire alarm/mass notification devices, cabinets and panels. The Fire Alarm technicians testing the equipment shall be factory trained in the installation, adjustment, testing, and operation of the equipment specified herein and on the drawings.

E. Manufacturer’s Representative
1. The fire alarm and mass notification equipment manufacturer’s representative shall be present for the connection of wiring to the control panel. The Manufacturer’s Representative shall be an employee of the manufacturer with necessary technical training (NICET Level IV) on the system being installed.
F. Manufacturer

1. Components shall be of current design and shall be in regular and recurrent production at the time of installation. Provide design, materials, and devices for a protected premises fire alarm system, complete, conforming to NFPA 72, except as otherwise or additionally specified herein.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and Equipment: All materials and equipment in the system shall be new and current products of a manufacturer regularly engaged in the production of such materials and equipment. Where two or more pieces of equipment are required to perform interrelated functions, they shall be products of one manufacturer.

B. Approval Guides: Unless otherwise indicated, all products shall be listed in the latest publication of the Underwriters Laboratory Fire Protection Directory or the Factory Mutual Approval Guide.

C. Schedule of Pipe: All pipe shall be schedule 40 ferrous.

D. Threaded Fittings: Threaded fittings shall be cast iron class 125, rated for 175 psi cold water working pressure and shall conform to ANSI B16.4, ASTM 126 and ANSI B2.1 NPT.

E. Grooved Fittings: 90's, 45's, Tees, and reducers shall be malleable iron or ductile. The fittings shall be by Gustin Bacon, Gruvlok, Victaulic, or approved equal.

F. Adapter Flanges: Adapter flanges (fittings) shall be cast iron/class 125 conforming to ANSI B 16.1, with a rust inhibiting coating. The adapter flanges shall be by Gustin Bacon, Gruvlok, Victaulic, or approved equal.

G. Grooved Couplings: Grooved couplings and reducers shall be malleable or ductile iron conforming to ASTM A 47.

H. Plain End Couplings: Plain-end couplings are permitted when installed in complete conformance with their listings.

I. Hangers: Provide hangers to support all piping in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet the requirements of NFPA 13.

J. Pipe Rings: Pipe rings to be zinc coated Grinnell figure 69 or equal.

K. Earthquake bracing shall be with a pipe clamp and pipe with a swivel type anchor or similar to those illustrated in NFPA 13. Other types of bracing may be used when UL-listed or FM approved.

L. Butterfly Valves: Butterfly valves shall be Gruvlok Model 7700 FP with integral tamper switch, or approved equal. Externally mounted tamper switches are also permissible.

M. Drain Valves: Drain valves shall be screw in bonnet bronze globe valves, rated to 175 psi non shock cold water working pressure by Nibco, United or approved equal. Low point drain valves shall have, in addition, a ¾ inch brass nipple with ¾ inch male hose threads and cap.

N. Check valves shall be grooved, iron body, bronze seat, stainless steel clapper with a replaceable rubber seal and 175 psi non shock cold water working pressure. Viking model D, Central model 90 or approved equal.

O. Provide quick response sprinklers throughout.
P. Sprinklers in ceilings shall be glass bulb, white finish, with white recessed escutcheon.

Q. Sidewall sprinklers in finished areas shall be white finish in white recessed escutcheon.

R. Spare Sprinklers: Provide spare sprinklers and escutcheons for each type and style of sprinkler used in accordance with NFPA 13 and proportioned based upon the number of each type and style of sprinkler used on the project.

S. Provide spare sprinklers to Base Installation Department of Public Works.

T. Provide chrome- or nickel-plated, UL Listed sprinkler headguards for sprinkler heads subject to mechanical damage or for any sprinkler lower than 7 feet above the floor. All sprinklers in the in exposed area shall be provided with plated head guards.

U. Provide a 3½ inch diameter, bourdon type pressure gauge, 0 200 lbs, ¼ inch soft metal seat globe valve with arrangements for draining pipe between gage and valve.

V. Provide metal split ring type escutcheons. Escutcheons are only required where wall penetrations are exposed.

W. Equipment in this section shall be provided, installed, and adjusted by the sprinkler Contractor. Conduit, wiring, and terminations, shall be by others.

X. Waterflow Switch: Potter VSR F or approved equal.

Y. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position

Z. Provide all control, drain and test valves with signs identifying the type of valve and the area affected by the valve. Signs shall be three layer etched plastic with red letters on a white background to identify valves above ceilings or behind access doors. Lithographed metal plates may be used in unfinished spaces or above ceilings. Provide hydraulic design information plates as required by NFPA 13.

AA. Firestopping material is to be UL classified Bio Fireshield BFS100, 200 caulk or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Requirements Prior to Installation: Do not order, fabricate, or install any material prior to receipt of all approvals as stipulated in Part 1 of this Section.

B. The most current architectural backgrounds shall be used to produce shop drawings. Obtain these from the architect prior to starting design.

C. Standards and Requirements: All installation work shall be performed in accordance with the reference standards without exception, and as required by the AHJ. All piping shall be installed straight, true and plumb.

D. Changes to the Work: Install all piping as shown on the approved shop drawings. Minor deviations shall be carefully noted on the record drawings as outlined in Part 1 of this Section. Before making significant deviations from the approved drawings, written approval must be obtained from the Owner and the AHJ.
E. Coordination of Work: Carefully coordinate work with other trades so that unnecessary offsets and revisions to the approved drawings are avoided. Failure to coordinate does not relieve Contractor from meeting the performance standards herein. The contractor is responsible for completely coordinating with all other trades and building conditions, providing all offsets as necessary for a completely coordinated installation. No extras will be allowed for resolving conflicts with other trades.

F. Sprinklers shall be spaced in accordance with NFPA 13 and as noted in Part 2 of this specification.

G. In addition to the sprinklers indicated on the drawings, provide all design, materials, and labor for installation of 6 additional sprinklers as directed by the AHJ or the engineer.

H. Provide plated head guards for all sprinklers in exposed areas.

I. Required Clearance Around Pipe: Piping passing through fire rated assemblies, including fire rated GWB assemblies shall be provided with clearance around the entire circumference of the pipe. Penetrations shall be made in a neat manner using properly sized hole saw or masonry/concrete coring as necessary.

J. Fire Rated Assemblies: The annular spaces around sprinkler pipes which penetrate fire rated assemblies shall be filled with UL classified firestopping material in accordance with the manufacturer's recommendations. Penetrations of all fire-rated assemblies shall be protected. The shop drawings or material submittals shall clearly depict the firestopping assembly proposed by the contractor.

K. Escutcheons: Split wall plates or escutcheons shall be installed where exposed piping or hangers pass through a finished floor, wall or ceiling and shall fit snugly, securely and cover the opening.

L. Install all control valves and test valves in locations indicated on the plans. Auxiliary drain valves shall be installed in easily accessible locations.

M. Main Drains: Provide main drains for all systems as shown on the drawings. Main drains shall discharge to a safe location outside of the building.

N. Auxiliary Drains: Provide auxiliary drains at all low points of the system, where the trapped section of pipe exceeds five gallons. The drain shall consist of, as a minimum: a valve, a ¾ inch brass nipple with ¾ inch male hose threads, and cap.

O. Provide remote inspectors test drains as required by the AHJ.

P. Sprinklers in 2 x 2 ceiling tiles shall be located in the center of tile, plus or minus 1/2 inch. Sprinklers in 2 x 4 ceiling tiles shall be located at the quarter points, plus or minus 1/2 inch.

Q. Where surface mounted lights present an obstruction to sprinkler spray pattern, 401 canopies shall be used.
3.2 FIELD QUALITY CONTROL

A. Hydrostatic tests shall be performed in the presence of the AHJ. Any leaks or drips shall be promptly repaired. Evidence of the completed tests shall be conveyed to the A/E by submitting a completed contractor's Material and Test Certificate.

B. Punch List: Deficiencies found in the installation will be recorded on a punch list and delivered to Contractor. All items on the punch list shall be promptly corrected. Notify the A/E in writing once all punch list items have been corrected.
SECTION 22 00 00
PLUMBING – GENERAL PROVISIONS

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS
A. Refer to BIDDING REQUIREMENTS, CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS and DIVISION 00 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. 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.

2. 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 01 50 00 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 01 33 00 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 01 77 00 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 00 04 04 Substitutions 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 00 04 04 Substitutions.

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
SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

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 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.

1.4 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.
1.5 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.

1.6 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.

1.7 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.

1.8 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.

1.9 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 72 00 “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.

1.10 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.

1.11 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.

1.12 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.

1.13 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.
1.14 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.

1.15 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.

C. Refer to Section 08 31 00 “Access Doors.”

END OF SECTION
SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.
   4. Bronze swing check valves.

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. Handwheel: For valves other than quarter-turn types.
   2. Handlever: For quarter-turn valves NPS 6 (DN 150) and smaller.
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 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 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.

2.5 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.
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.
   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 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.

END OF SECTION 22 05 23
SECTION 22 11 16
DOMESTIC WATER PIPING

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. Flexible connectors.
   3. Escutcheons.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
   B. Field quality-control reports.

1.3 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 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.4 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.

2.5 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 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.

D. 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)] <Insert pressure and temperature>.
      c. End Connections: Male threaded or grooved.
      d. Lining: Inert and noncorrosive, propylene.
2.6 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.

2.7 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

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 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 "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level without pitch and plumb.

F. Install piping adjacent to equipment and specialties to allow service and maintenance.

G. Install piping to permit valve servicing.

H. 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.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.
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. 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."

D. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

E. 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.”

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

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.

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 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
B. 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.

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.

E. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.8 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. 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.
   2. 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.

3.9 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.
3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.11 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.

3.12 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.

3.13 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. Aboveground domestic water piping shall be one of the following:
   1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) copper solder-joint fittings; and soldered joints.
   2. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); copper pressure-seal-joint fittings; and pressure-sealed joints.

3.14 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.

END OF SECTION
SECTION 22 11 19
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following domestic water piping specialties:
   1. Temperature-actuated water mixing valves.
   2. Water hammer arresters.

B. See Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

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.

PART 2 - PRODUCTS

2.1 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.

2.2 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.
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 temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

C. Install water hammer arresters in water piping according to PDI-WH 201.

D. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

3.2 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION
SECTION 22 13 16
SANITARY WASTE AND VENT PIPING

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
A. 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.
   B. 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:
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. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.


D. 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.

E. 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. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

D. 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."

E. 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."

F. 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."

G. 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.

H. 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.

I. 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.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.

L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

M. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
N. 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. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. 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.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

F. 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).

G. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

H. 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.

I. Install supports for vertical steel piping every 15 feet (4.5 m).

J. 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.

K. Install supports for vertical copper tubing every 10 feet (3 m).

L. 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
SECTION 22 13 19
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
4. Flashing materials.

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 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.

2.2 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: [Extra Heavy-Duty] [Heavy Duty] [Light Duty] [Medium Duty] (Delete if not applicable).
11. Trap Material: Cast iron.

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: Counterflashing-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.

2.3 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.

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 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.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. 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.

F. Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install floor-drain, trap-seal primer fittings on inlet to floor outlets 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.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. 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.
M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

N. 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.

3.3 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. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 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 22 13 19
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Faucets for lavatories, showers and sinks.
2. Flushometers.
3. Toilet seats.
4. Protective shielding guards.
5. Fixture supports.
7. Urinals.
8. Lavatories.
10. Service sinks.

B. Related Sections include the following:

1. Division 22 Section "Drinking Fountains and Water Coolers."

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 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.


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.
5. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
9. Vitreous-China Fixtures: ASME A112.19.2M.

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.
7. 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.

C. Lavatory Supports – Wall Mounted:
   1. Description: Type I, lavatory carrier with exposed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.

2.7 WATER CLOSETS

A. Water Closets
1. Description: Wall-mounting, wall-outlet, vitreous-china fixture designed for flushometer valve operation.
   a. Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
   b. Height: Standard or Accessible.
   c. Flushometer: Auto Sensor actuator.

2.8 URINALS

A. Urinals
1. Description: Accessible, wall or Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   a. Type: Washout with extended shields.
   b. Strainer or Trapway Open trapway with integral trap.
   d. Flushometer: Auto Sensor actuator
   e. Fixture Support: Urinal chair carrier.

2.9 LAVATORIES

A. Lavatories,
1. Description: Accessible, wall, Wall or counter-top vitreous-china fixture.
   a. Type: Ledge back or drop-in.
   c. Faucet: Lavatory – Auto Sensor Type.
   e. Drain: Grid or Grid with offset waste.
   f. Drain Piping: NPS 1-1/4 by NPS 1-1/2 (DN 32 by DN 40) chrome-plated, cast-brass P-trap; tubular brass waste to wall; and wall escutcheon.
   g. Protective Shielding Guard(s): Required on Accessible Wall Mounted Lavatories.
   h. Fixture Support: Lavatory.

2.10 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).
2.11 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.
   3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-mounting fixtures with tubular waste piping attached to supports.

F. Install fixtures level and plumb according to roughing-in drawings.

G. 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.

H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

K. Install toilet seats on water closets.

L. 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.

M. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
N. 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.

O. Install traps on fixture outlets.
   1. Exception: Omit trap on fixtures with integral traps.
   2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

P. 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."

Q. 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 according to Division 26 Section "Grounding and Bonding for Electrical Systems."

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.
SECTION 22 47 00
DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Style W, wall-mounting drinking fountains.
2. Type PB, pressure with bubbler, Style W, wall-mounting water coolers.
3. Fixture supports.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Diagram power, signal, and control wiring.
C. Operation and maintenance data.

1.3 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.


C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.


F. ASHRAE Standard: Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants" for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

A. Drinking Fountains
1. Description: Accessible, Dual Height, Style W, wall-mounting drinking fountain.

   b. Receptor Shape: Round.
   d. Bubblers: One per bowl, with adjustable stream regulator, located on deck.
   e. Control: Push bar.
   f. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
   g. Drain: Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.2.
   h. Support: Type I, water cooler carrier. Refer to “Fixture Supports” Article.

2.2 ELECTRIC WATER COOLERS

A. Water Coolers

1. Description: Accessible, Dual Height, ARI 1010, Type PB, pressure with bubbler, Style W, wall-mounting water cooler for adult-mounting height.

   a. Cabinet: Bilevel with two attached cabinets, all stainless steel.
   b. Bubblers: One, with adjustable stream regulator, located on each cabinet deck.
   c. Control: Push bar.
   d. Supply: NPS 3/8 (DN 10) with ball, gate, or globe valve.
   e. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
   f. Drain(s): Grid with NPS 1-1/4 (DN 32) minimum horizontal waste and trap complying with ASME A112.18.1.
   g. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant metal storage tank, and adjustable thermostat.

   1) Capacity: 5 gph (0.0053 L/s) of 50 deg F (10 deg C) cooled water from 80 deg F (27 deg C) inlet water and 90 deg F (32 deg C) ambient air temperature.
   2) Electrical Characteristics: 120-V ac; single phase; 60 Hz.

   h. Support: water cooler carrier. Refer to “Fixture Supports” Article.

2.3 FIXTURE SUPPORTS

A. Description: ASME A112.6.1M, water cooler carriers. Include vertical, steel uprights with feet and tie rods and bearing plates with mounting studs matching fixture to be supported.

1. Type I: Hanger-type carrier with two vertical uprights.
2. Type II: Bilevel, hanger-type carrier with three vertical uprights.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view.

3.2 INSTALLATION

A. Install off-floor supports affixed to building substrate and attach wall-mounting fixtures, unless otherwise indicated.

B. Install fixtures level and plumb. For fixtures indicated for children, install at height required by authorities having jurisdiction.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to water distribution piping. Use ball, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install pipe escutcheons at wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding pipe fittings. Escutcheons are specified in Division 22 Section "Common Work Results for Plumbing."

F. Seal joints between fixtures and walls and floors using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Sealants are specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, traps, and risers, and with soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Water Cooler Testing: After electrical circuitry has been energized, test for compliance with requirements. Test and adjust controls and safeties.

   1. Remove and replace malfunctioning units and retest as specified above.
   2. Report test results in writing.

3.5 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust water cooler temperature settings.

END OF SECTION
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. 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.

2. 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 01 50 00 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 01 33 00
Submittal 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 8½” 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).
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 01 77 00 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

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.

1.15 EQUIPMENT/MATERIAL SUBSTITUTIONS
A. Refer to Section 00 04 04 Substitutions 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 00 04 04 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.

1.16 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.

1.17 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.

1.18 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.

1.19 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.

1.20 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.

1.21 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.

1.22 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. Extent of Asbestos: See Section 003126 Existing Hazardous Materials information and Section 028200 Asbestos abatement.

2. 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.

1.23 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.

1.24 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
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 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 72 00 “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 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.

C. Refer to Section 08 31 00 "Access Doors."

END OF SECTION
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] <Insert class>.

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 "Water-Based Fire-Suppression 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.
   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 23 05 29
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. Hydronic Piping Systems:
   a. Constant-flow systems.
   b. Variable-flow systems.

3. HVAC equipment quantitative-performance settings.
5. Existing systems TAB.
6. Verifying that automatic control devices are functioning properly.
7. 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 [AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems"] [NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems"] [SMACNA's TABB "HVAC Systems - Testing, Adjusting, and Balancing"] 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 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 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.

B. Prepare schematic diagrams of systems’ “as-built” piping layouts.

C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:

1. Open all manual valves for maximum flow.
2. Check expansion tank liquid level.
3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
4. Check flow-control valves for specified sequence of operation and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.9 PROCEDURES FOR HYDRONIC SYSTEMS

A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:

1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
4. Report flow rates that are not within plus or minus 5 percent of design.

B. Set calibrated balancing valves, if installed, at calculated presettings.

C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.

D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:

1. Determine the balancing station with the highest percentage over indicated flow.
2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
3. Record settings and mark balancing devices.

F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems’ pressures and temperatures including outdoor-air temperature.

G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

3.10 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.11 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.

3.12 PROCEDURES FOR CHILLERS

A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:

1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
2. If water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
4. Power factor if factory-installed instrumentation is furnished for measuring kilowatt.
5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatt.
7. If air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.13 PROCEDURES FOR CONDENSING UNITS
A. Verify proper rotation of fans.
B. Measure entering- and leaving-air temperatures.
C. Record compressor data.

3.14 PROCEDURES FOR BOILERS
A. If hydronic, measure entering- and leaving-water temperatures and water flow.
B. If steam, measure entering-water temperature and flow and leaving steam pressure, temperature, and flow.

3.15 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.
3.16 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.

3.17 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.

3.18 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.

3.19 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.
3.20 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.

3.21 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.

3.22 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
SECTION 23 07 00
HVAC INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation Materials:
      a. Mineral or glass fibers.
   2. Insulating cements.
   3. Adhesives.
   5. Sealants.
   6. Factory-applied jackets.
   7. Tapes.
   8. Securements.
   9. Corner angles.

B. Related Sections:
   1. Division 22 Section "Plumbing Insulation."
   2. Division 23 Section "Metal Ducts" for duct liners.

1.2 SUBMITTALS

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

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. 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.

F. 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.

G. 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 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.3 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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.


E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 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.

2.5 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).

2.6 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.
2.7 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.

2.8 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] [Stainless steel], 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] [stainless-steel] 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.

2.9 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)] [4 inches (100 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

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 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.
3.6 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.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.

3.8 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.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Pipe insulation thickness shall be in accordance with ASHRAE 90.1.

END OF SECTION
SECTION 23 09 00

INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY
   A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
   B. Comply with UFC 3-410-02 – Design; HVAC Direct Digital Control Systems - Lonworks.

1.2 SUBMITTALS
   A. Product Data: For each control device indicated.
   B. Shop Drawings:
      1. Schematic flow diagrams.
      2. Power, signal, and control wiring diagrams.
      3. Details of control panel faces.
      4. Damper schedule.
      5. Valve schedule.
      6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
      7. Control System Software: Schematic diagrams, written descriptions, and points list.
   C. Software and firmware operational documentation.
   D. Field quality-control test reports.
   E. Operation and maintenance data.

1.3 QUALITY ASSURANCE
   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.

PART 2 - PRODUCTS

2.1 CONTROL SYSTEM
   A. Manufacturers:
      1. Distech.
2. Coordinate with the Post for connection and extension of the existing system comply with UFC 3-410-02

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.2 DDC EQUIPMENT

A. Operator Workstation: PC-based microcomputer with minimum configuration as follows:

1. Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
2. Processor: As recommended by DDC software package.
3. Random-Access Memory: 2 GB.
4. Graphics: Video adapter, minimum – As recommended by DDC software package.
5. Monitor: 19 inches (480 mm), LCD color.
7. Hard-Disk Drive: 500 GB.
8. DVD/CD-ROM Read/Write Drive:
11. Operating System: Microsoft Windows XP Professional with high-speed Internet access.
12. Printer: Color, ink-jet

B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
   d. Software applications, scheduling, and alarm processing.
   e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
   a. Global communications.
   b. Discrete/digital, analog, and pulse I/O.
   c. Monitoring, controlling, or addressing data points.
3. Local operator interface provides for download from or upload to operator workstation.

D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
7. Universal I/Os: Provide software selectable binary or analog outputs.

E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.3 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).

2.4 ANALOG CONTROLLERS

A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.

B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 70 deg F (minus 23 to plus 21 deg C), and single- or double-pole contacts.
C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.

1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.

D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 55 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.

2.5 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
4. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Concealed.
b. Set-Point Indication: Concealed.
c. Thermometer: Concealed.
d. Color: Mfr’s standard.
e. Orientation: Vertical.

7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.

C. RTDs and Transmitters:

1. Accuracy: Plus or minus 0.2 percent at calibration point.
2. Wire: Twisted, shielded-pair cable.
3. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
4. Averaging Elements in Ducts: 18 inches (460 mm) long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (0.84 sq. m); length as required.
5. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
6. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Concealed.
b. Set-Point Indication: Concealed.
c. Thermometer: Concealed.
d. Color: Mfr’s standard.
e. Orientation: Vertical.

7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
D. Humidity Sensors: Bulk polymer sensor element.

1. Accuracy: 5 percent full range with linear output.
2. Room Sensor Range: 20 to 80 percent relative humidity.
3. Room Sensor Cover Construction: Manufacturer's standard locking covers.
   a. Set-Point Adjustment: Concealed.
   b. Set-Point Indication: Concealed.
   c. Orientation: Vertical.
4. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
5. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of minus 22 to plus 185 deg F (minus 30 to plus 85 deg C).
6. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
   a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
   b. Output: 4 to 20 mA.
   c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
   d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).

2. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
3. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
4. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
5. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

F. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base or Metal wire, tamperproof.
3. Adjusting Key: As required for calibration and cover screws.

2.6 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
E. **Power Monitor:** 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. **Current Switches:** Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. **Electronic Valve/Damper Position Indicator:** Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. **Water-Flow Switches:** Bellows-actuated mercury or snap-actuating type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.7 **GAS DETECTION EQUIPMENT**

A. **Carbon Monoxide Detectors:** Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F (0 to 40 deg C); with 2 factory-calibrated alarm levels at 50 and 100 ppm.

B. **Carbon Dioxide Sensor and Transmitter:** Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output; for wall mounting.

C. **Occupancy Sensor:** Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment; for flush mounting.

2.8 **THERMOSTATS**

A. **Low-Voltage, On-Off Thermostats:** NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

B. **Line-Voltage, On-Off Thermostats:** Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

1. **Electric Heating Thermostats:** Equip with off position on dial wired to break ungrounded conductors.
2. **Selector Switch:** Integral, manual on-off-auto.

C. **Electric, Low-Limit Duct Thermostat:** Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.

1. **Bulb Length:** Minimum 20 feet (6 m).
2. **Quantity:** One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

D. **Electric, High-Limit Duct Thermostat:** Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.

1. **Bulb Length:** Minimum 20 feet (6 m).
2. **Quantity:** One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.
2.9 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.

1. Comply with requirements in Division 23 Section “Common Motor Requirements for HVAC Equipment.”
2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Non-Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
4. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
5. Non-Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close off at maximum pump differential pressure.
2. Dampers: Size for running torque calculated as follows:
   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. (49.6 kg-cm/sq. m) of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. (37.2 kg-cm/sq. m) of damper.
   e. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
   f. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
4. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
5. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
6. Power Requirements (Two-Position Spring Return): 120 V ac.
7. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
9. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
10. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
11. Run Time: 12 seconds open, 5 seconds closed.

2.10 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Hydronic system characterized ball valves shall have the following characteristics:

1. NPS 3 (DN 75) and Smaller: Class 125 brass body, stainless steel ball, stainless steel stem, Teflon PTFE seats, EPDM O-rings, screwed or soldered ends.
2. Internal Construction: Composite or stainless steel characterizing disc.- equal percentage type
3. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate or the following:
b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

5. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

C. Butterfly Valves: NPS 4 (DN 100) and larger: 200-psig (1380-kPa), maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Wafer, Lug or Grooved.
2. Disc Type: Nickel-plated ductile iron or Aluminum bronze.
3. Sizing: 1-psig (7-kPa) maximum pressure drop at design flow rate.

D. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.

1. Rating: Class 125 for service at 125 psig (860 kPa) and 250 deg F (121 deg C) operating conditions.
2. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate, to close against pump shutoff head.
3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.11 DAMPERS

A. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch- (2.8-mm-) minimum thick, galvanized-steel or 0.125-inch- (3.2-mm-) minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- (1.6-mm-) thick galvanized steel with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).

1. Secure blades to 1/2-inch- (13-mm-) diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze or nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).
3. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1000 Pa) when damper is held by torque of 50 in. x lbf (5.6 N x m); when tested according to AMCA 500D.

2.12 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section “Communications Horizontal Cabling.”
PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches (1220 mm) above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

C. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

E. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

F. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."

G. Install refrigerant instrument wells, valves, and other accessories according to Division 23 Section "Refrigerant Piping."

H. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

I. Install electronic and fiber-optic cables according to Division 27 Section "Communications Horizontal Cabling."

3.2 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Install signal and communication cable according to Division 27 Section "Communications Horizontal Cabling."

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test, and adjust, field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:
   a. Verify that DDC controller power supply is from emergency power supply, if applicable.
   b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
   c. Verify that spare I/O capacity has been provided.
   d. Verify that DDC controllers are protected from power supply surges.

D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.
3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 23 09 00
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes refrigerant piping used for ductless split-system air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS
A. Line Test Pressure for Refrigerant R-22:

1.3 SUBMITTALS
A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.
B. Shop Drawings.
   1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
C. Field quality-control test reports.
D. Operation and maintenance data.

1.4 QUALITY ASSURANCE
B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING
A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.
PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L (ASTM B 88M, Type A or B).

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Service Valves:
   1. Body: Forged brass with brass cap including key end to remove core.
   2. Core: Removable ball-type check valve with stainless-steel spring.
   4. End Connections: Copper spring.

B. Moisture/Liquid Indicators:
   2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
   3. Indicator: Color coded to show moisture content in ppm.
   5. End Connections: Socket or flare.

C. Permanent Filter Dryers: Comply with ARI 730.
   2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
   3. Desiccant Media: Activated [alumina] [charcoal].
   4. Designed for reverse flow (for heat-pump applications).
   5. End Connections: Socket.
   7. Maximum Pressure Loss: [2 psig (14 kPa)] <Insert value>.
2.3 REFRIGERANTS
   A. As recommended by unit manufacturer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS
   A. Suction Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.
   B. Hot-Gas and Liquid Lines: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS
   A. Install service valves where recommended by unit manufacturer.
   B. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
   C. Install filter dryers in liquid line between compressor and thermostatic expansion valve.

3.3 PIPING INSTALLATION
   A. Install refrigerant piping according to ASHRAE 15.
   B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
   C. 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.
   D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
   E. Install piping adjacent to machines to allow service and maintenance.
   F. Install piping free of sags and bends.
   G. Install fittings for changes in direction and branch connections.
   H. Select system components with pressure rating equal to or greater than system operating pressure.
   I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
   J. Install refrigerant piping in protective conduit where installed belowground.
K. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

L. Install pipe sleeves at penetrations in exterior walls and floor assemblies.

M. Seal penetrations through fire and smoke barriers according to Division 07 Section "Penetration Firestopping."

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Install sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.

P. Seal pipe penetrations through exterior walls according to Division 07 Section "Joint Sealants" for materials and methods.

Q. Identify refrigerant piping and valves according to Division 23 Section "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
   1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
   2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:
   1. Comply with ASME B31.5, Chapter VI.
   2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
   3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
      a. Fill system with nitrogen to the required test pressure.
      b. System shall maintain test pressure at the manifold gage throughout duration of test.
      c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
      d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 23 23 00
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 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[seismic restraints, and vibration isolation.

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.

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)] [G90 (Z275)].
   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: Electroplated, 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. 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 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."

3.3 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.

3.4 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 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.

3.5 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.

3.6 DUCT SCHEDULE

A. Fabricate ducts with 22g galvanized sheet steel.
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
SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Backdraft and pressure relief dampers.
   3. Flange connectors.
   4. Turning vanes.
   5. Flexible connectors.
   6. Flexible ducts.
   7. Duct accessory hardware.

1.2 SUBMITTALS

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

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. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. 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 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.

2.5 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, "Vaners and Vane Runners," and 2-4, "Vane Support in Elbows."
D. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.6 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.

2.7 FLEXIBLE DUCTS

A. 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).

B. 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.

2.8 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 flexible connectors to connect ducts to equipment.

I. 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.

J. 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.

K. 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.

L. Connect flexible ducts to metal ducts with draw bands.

M. Install duct test holes where required for testing and balancing purposes.

N. 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.

END OF SECTION
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-) ] [5/8-inch- (16-mm-) ] [3/4-inch- (19-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 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. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

E. 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."

F. Install ducts adjacent to power ventilators to allow service and maintenance.

G. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

H. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

2.3 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 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Shutoff single-duct air terminal units.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
B. 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. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 SHUTOFF SINGLE-DUCT AIR TERMINAL UNITS

A. Configuration: Volume-damper assembly inside unit casing with control components located inside a protective metal shroud.
B. Casing: 0.034-inch (0.85-mm) steel
   1. Casing Lining: 1/2-inch- (13-mm-) thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
   2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
   3. Air Outlet: S-slip and drive connections, size matching inlet size.
   4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket.
C. Regulator Assembly: Extruded-aluminum or galvanized-steel components; key damper blades onto shaft with nylon-fitted pivot points located inside unit casing.
   1. Automatic Flow-Control Assembly: Combined spring rates shall be matched for each volume-regulator size with machined dashpot for stable operation.
2. Factory-calibrated and field-adjustable assembly with shaft extension for connection to externally mounted control actuator.

D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
   1. Maximum Damper Leakage: ARI 880 rated, 3 percent of nominal airflow at 6-inch wg (1500-Pa) inlet static pressure.

E. Attenuator Section: 0.034-inch (0.85-mm) steel sheet metal.
   1. Lining: 1-inch (25-mm) thick, coated, fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.

F. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 200 psig (1380 kPa); and factory installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.

B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to air terminal units to allow service and maintenance.

D. Hot-Water Piping: In addition to requirements in Division 23 Section "Hydronic Piping," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.

E. Connect ducts to air terminal units according to Division 23 Section "Metal Ducts".

F. Ground units with electric heating coils according to Division 26 Section "Grounding and Bonding for Electrical Systems."

G. 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. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
   2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove and replace malfunctioning units and retest as specified above.
END OF SECTION 23 36 00
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. 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.
B. 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
SECTION 23 41 00
PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes factory-fabricated air-filter devices and media used to remove particulate matter from air for HVAC applications.

1.2 SUBMITTALS
A. Product Data: Include dimensions; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each unit indicated.
B. Shop Drawings: Include plans, elevations, sections, and details to illustrate component assemblies and attachments.
   1. Show filter rack assembly, dimensions, materials, and methods of assembly of components.
   2. Include setting drawings, templates, and requirements for installing anchor bolts and anchorages.
   3. Include wiring diagrams.
C. 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. Comply with ARI 850.
C. Comply with ASHRAE 52.1 and ASHRAE 52.2 for method of testing and rating air-filter units.
D. Comply with NFPA 90A and NFPA 90B.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with holding frames.
   1. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
   2. Frame: [Cardboard frame with perforated metal retainer] [Galvanized steel with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles].
   3. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.
B. Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with holding frames.

1. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
2. Media and Media-Grid Frame: [Nonflammable cardboard] [Galvanized steel] [Fire-retardant, 3/4-inch (19-mm) particleboard with gaskets].
3. Duct-Mounting Frames: Welded, galvanized steel with gaskets and fasteners, and suitable for bolting together into built-up filter banks.

C. Side-Service Housings: Factory-assembled, side-service housings, constructed of galvanized steel, with flanges to connect to duct system.

1. Integral Tracks: Accommodate 2-inch (50-mm) disposable or washable filters.
2. Access Doors: Continuous gaskets on perimeter and positive-locking devices. Arrange so filter cartridges can be loaded from either access door.
3. Sealing: Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass of unfiltered air.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

B. Install filters in position to prevent passage of unfiltered air.

C. Coordinate filter installations with duct and air-handling unit installations.

D. Electrical wiring and connections are specified in Division 26 Sections.

END OF SECTION 23 41 00
SECTION 23 73 13
MODULAR INDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Constant-air-volume, single-zone air-handling units.
2. Variable-air-volume, single-zone air-handling units.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Casing panels shall be self-supporting and capable of withstanding 133 percent of internal static pressures indicated, without panel joints exceeding a deflection of L/200 where "L" is the unsupported span length within completed casings.

1.4 ACTION SUBMITTALS

A. Product Data: For each air-handling unit indicated.

1. Unit dimensions and weight.
2. Cabinet material, metal thickness, finishes, insulation, and accessories.
3. Fans:
   a. Certified fan-performance curves with system operating conditions indicated.
   b. Certified fan-sound power ratings.
   c. Fan construction and accessories.
   d. Motor ratings, electrical characteristics, and motor accessories.

4. Certified coil-performance ratings with system operating conditions indicated.
5. Dampers, including housings, linkages, and operators.
6. Filters with performance characteristics.

B. Delegated-Design Submittal: For vibration isolation 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. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-handling units to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set for each air-handling unit.

2. QUALITY ASSURANCE

A. 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.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

C. ARI Certification: Air-handling units and their components shall be factory tested according to ARI 430, "Central-Station Air-Handling Units," and shall be listed and labeled by ARI.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

E. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. Comply with NFPA 70.
1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carrier Corporation; a member of the United Technologies Corporation Family.
   2. Daikin
   3. Trane.

2.2 UNIT CASINGS

A. General Fabrication Requirements for Casings:
   1. Forming: Form walls, roofs, and floors with at least two breaks at each joint.
   2. Casing Joints: Sheet metal screws or pop rivets.
   3. Sealing: Seal all joints with water-resistant sealant.
   5. Factory Finish for Galvanized-Steel Casings: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on enamel finish, consisting of prime coat and thermosetting topcoat.
   6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Casing Insulation and Adhesive:
   1. Materials: ASTM C 1071, Type I and Type II.
   2. Location and Application: Factory applied with adhesive and mechanical fasteners to the internal surface of section panels downstream from, and including, the cooling-coil section.
      a. Liner Adhesive: Comply with ASTM C 916, Type I.
      b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
      c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service-air velocity.
   3. Location and Application: Encased between outside and inside casing.

C. Inspection and Access Panels and Access Doors:
   1. Panel and Door Fabrication: Formed and reinforced, single- or double-wall and insulated panels of same materials and thicknesses as casing.
2. Inspection and Access Panels:
   a. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
   b. Gasket: Neoprene, applied around entire perimeters of panel frames.
   c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Access Doors:
   a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
   b. Gasket: Neoprene, applied around entire perimeters of panel frames.
   c. Size: At least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.

4. Locations and Applications:
   a. Fan Section: Door.
   b. Access Section: Doors.
   c. Coil Section: Door.
   d. Damper Section: Doors.
   e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
   f. Mixing Section: Doors.

D. Condensate Drain Pans:
   1. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
      a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      b. Depth: A minimum of 2 inches deep.
   3. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
   5. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

E. Air-Handling-Unit Mounting Frame: Formed galvanized-steel channel or structural channel supports, designed for low deflection, welded with integral lifting lugs.

2.3 FAN, DRIVE, AND MOTOR SECTION

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.
   1. Shafts: Designed for continuous operation at maximum-rated fan speed and motor horsepower, and with field-adjustable alignment.
a. Turned, ground, and polished hot-rolled steel with keyway. Ship with a protective coating of lubricating oil.
b. Designed to operate at no more than 70 percent of first critical speed at top of fan’s speed range.

B. Centrifugal Fan Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

1. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
2. Horizontal-Flanged, Split Housing: Bolted construction.
3. Housing for Supply Fan: Attach housing to fan-section casing with metal- edged flexible duct connector.
4. Flexible Connector: Factory fabricated with a fabric strip 3-1/2 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized-steel sheet or 0.032-inch-thick aluminum sheets; select metal compatible with casing.

   1) Fabric Minimum Weight: 26 oz./sq. yd.
   2) Fabric Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3) Fabric Service Temperature: Minus 40 to plus 200 deg F.

C. Airfoil, Centrifugal Fan Wheels: Smooth-curved inlet flange, backplate, and hollow die-formed airfoil-shaped blades continuously welded at tip flange and backplate; cast-iron or cast-steel hub riveted to backplate and fastened to shaft with set screws.

D. Fan Shaft Bearings:

1. Prelubricated and Sealed, Ball Bearings: Self-aligning, pillow-block type with a rated life of 50,000 hours according to ABMA 9.
2. Grease-Lubricated, Tapered-Roller Bearings: Self-aligning, pillow-block type with double-locking collars and 2-piece, cast-iron housing with grease lines extended to outside unit and a rated life of 50,000 hours according to ABMA 11.
3. Grease-Lubricated Bearings: Self-aligning, pillow-block-type, ball or roller bearings with adapter mount and two-piece, cast-iron housing with grease lines extended to outside unit.

E. Belt Drives: Factory mounted, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory.
2. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
3. Belts: Oil resistant, nonsparking, and nonstatic; in matched sets for multiple-belt drives.
4. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA’s "HVAC Duct Construction Standards"; 0.1046-inch- (2.7-mm-) thick, 3/4-inch (20-mm) diamond-mesh wire screen, welded to steel angle frame; prime coated.

F. Internal Vibration Isolation: Fans shall be factory mounted with manufacturer's standard[restrained] vibration isolation mounting devices having a minimum static deflection of 2 inches.
G. Motor: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

1. Enclosure Type: Totally enclosed, fan cooled.
2. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
5. Mount unit-mounted disconnect switches on exterior of unit.

H. Variable Frequency Controllers:

1. Description: NEMA ICS 2, IGBT, PWM, VFC; listed and labeled as a complete unit and arranged to provide variable speed of an NEMA MG 1, Design B, 3-phase induction motor by adjusting output voltage and frequency.
2. Output Rating: 3-phase; 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
3. Unit Operating Requirements:
   a. Input ac voltage tolerance of 380 to 500 V, plus or minus 10.
   b. Input frequency tolerance of 50/60 Hz, plus or minus 6 percent.
   c. Minimum Efficiency: 96 percent at 60 Hz, full load.
   d. Minimum Displacement Primary-Side Power Factor: 96 percent.
   e. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 seconds.
   f. Starting Torque: 100 percent of rated torque or as indicated.
   g. Speed Regulation: Plus or minus 1 percent.
4. Isolated control interface to allow controller to follow control signal over an 11:1 speed range.
5. Internal Adjustability Capabilities:
   a. Minimum Speed: 5 to 25 percent of maximum rpm.
   b. Maximum Speed: 80 to 100 percent of maximum rpm.
   c. Acceleration: 2 to a minimum of 22 seconds.
   d. Deceleration: 2 to a minimum of 22 seconds.
   e. Current Limit: 50 to a minimum of 110 percent of maximum rating.
6. Self-Protection and Reliability Features:
   a. Input transient protection by means of surge suppressors.
   b. Undervoltage and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
   c. Adjustable motor overload relays capable of NEMA ICS 2, Class 10 performance.
   d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
   e. Instantaneous line-to-line and line-to-ground overcurrent trips.
   f. Loss-of-phase protection.
   g. Reverse-phase protection.
   h. Short-circuit protection.
   i. Motor overtemperature fault.
7. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in
either direction and returning motor to set speed in proper direction, without damage to
controller, motor, or load.

8. Power- Interruption Protection: To prevent motor from re-energizing after a power
interruption until motor has stopped.

9. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times
the minimum torque to ensure high-starting torque and increased torque at slow speeds.

10. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based
on output frequency for temperature protection of self-cooled, fan-ventilated motors at
slow speeds.

11. Door-mounted LED status lights shall indicate the following conditions:

   a. Power on.
   b. Run.
   c. Overvoltage.
   d. Line fault.
   e. Overcurrent.
   f. External fault.

12. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with
manual-speed-control potentiometer and elapsed time meter.

13. Meters or digital readout devices and selector switch, mounted flush in controller door
and connected to indicate the following controller parameters:

   a. Output frequency (Hertz).
   b. Motor speed (rpm).
   c. Motor status (running, stop, fault).
   d. Motor current (amperes).
   e. Motor torque (percent).
   f. Fault or alarming status (code).
   g. Proportional-integral-derivative (PID) feedback signal (percent).
   h. DC-link voltage (volts direct current).
   i. Set-point frequency (Hertz).
   j. Motor output voltage (volts).

14. Control Signal Interface:

   a. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20
      mA) and 6 programmable digital inputs.
   b. Remote signal inputs capable of accepting any of the following speed-setting input
      signals from the control system:

      1) 0 to 10-V dc.
      2) 0-20 or 4-20 mA.
      3) Potentiometer using up/down digital inputs.
      4) Fixed frequencies using digital inputs.
      5) RS485.
      6) Keypad display for local hand operation.

   c. Output signal interface with a minimum of 1 analog output signal (0/4-20 mA),
      which can be programmed to any of the following:

      1) Output frequency (Hertz).
      2) Output current (load).
      3) DC-link voltage (volts direct current).
      4) Motor torque (percent).
      5) Motor speed (rpm).
      6) Set-point frequency (Hertz).
d. Remote indication interface with a minimum of 2 dry circuit relay outputs (120-V ac, 1 A) for remote indication of the following:

1) Motor running.
2) Set-point speed reached.
3) Fault and warning indication (overtemperature or overcurrent).
4) High- or low-speed limits reached.

15. Communications: RS485 interface allows VFC to be used with an external system within a multidrop LAN configuration. Interface shall allow all parameter settings of VFC to be programmed via BMS control. Provide capability for VFC to retain these settings within the nonvolatile memory.

16. Integral Disconnecting Means: NEMA AB 1, instantaneous-trip circuit breaker with lockable handle.

17. Accessories:

a. Devices shall be factory installed in controller enclosure unless otherwise indicated.
c. Standard Displays:

1) Output frequency (Hertz).
2) Set-point frequency (Hertz).
3) Motor current (amperes).
4) DC-link voltage (volts direct current).
5) Motor torque (percent).
6) Motor speed (rpm).
7) Motor output voltage (volts).

2.4 COIL SECTION

A. General Requirements for Coil Section:

1. Comply with ARI 410.
2. Fabricate coil section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. For multizone units, provide air deflectors and air baffles to balance airflow across coils.
4. Coils shall not act as structural component of unit.

2.5 AIR FILTRATION SECTION

A. General Requirements for Air Filtration Section:

1. Comply with NFPA 90A.
2. Provide minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
3. Provide filter holding frames arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

B. Disposable Panel Filters:

1. Factory-fabricated, viscous-coated, flat-panel type.
2. Thickness: 2 inches.
3. Dust-Holding Capacity: 65%.
5. Recommended Final Resistance: .75 inches wg.
9. Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, hinged, and with pull and retaining handles.

C. Filter Gage:
   1. 3-1/2-inch-diameter, diaphragm-actuated dial in metal case.
   2. Vent valves.
   3. Black figures on white background.
   4. Front recalibration adjustment.
   5. 2 percent of full-scale accuracy.
   6. Range: 0 to 2.0-inch wg (0 to 500 Pa)
   7. Accessories: Static-pressure tips with integral compression fittings, 1/4-inch aluminum tubing, and 2- or 3-way vent valves.

2.6 DAMPERS

A. General Requirements for Dampers: Leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg pressure differential.

B. Damper Operators: Comply with requirements in Division 23 Section "Instrumentation and Control for HVAC."

C. Electronic Damper Operators:
   1. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
   2. Electronic damper position indicator shall have visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
   3. Operator Motors:
      a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC."
      b. Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
      c. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.

4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
6. Size dampers for running torque calculated as follows:
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
d. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm. Increase running torque by 2.0.

8. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
10. Power Requirements (Two-Position Spring Return): 24 or 120-V ac control contractor's option.
11. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
12. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
13. Temperature Rating: 25 to 120 deg F.
14. Run Time: 12 seconds open, 5 seconds closed

D. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with steel operating rods rotating in stainless-steel sleeve bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 5 cfm/sq. ft. at 1-inch wg and 9 cfm/sq. ft. at 4-inch wg.

E. Mixing Section: Multiple-blade, air-mixer assembly located immediately downstream of mixing section.

F. Combination Filter and Mixing Section:
   1. Cabinet support members shall hold 2-inch thick, pleated, flat, permanent or throwaway filters.
   2. Multiple-blade, air-mixer assembly shall mix air to prevent stratification, located immediately downstream of mixing box.

2.7 CAPACITIES AND CHARACTERISTICS
See Drawing schedule

2.8 SOURCE QUALITY CONTROL

A. Fan Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Fans shall bear AMCA-certified sound ratings seal.

B. Fan Performance Rating: Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency. Rate performance according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."

C. Water Coils: Factory tested to 300 psig (2070 kPa) according to ARI 410 and ASHRAE 33.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for steam, hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.

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

3.2 INSTALLATION

A. Equipment Mounting: Install air-handling units on concrete bases using restrained spring isolators. Secure units to anchor bolts installed in concrete bases.
   
   1. Minimum Deflection: 2 inches (50 mm).
   2. Install galvanized plate to equally distribute weight over elastomeric pad.
   3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
   4. Install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   6. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Arrange installation of units to provide access space around air-handling units for service and maintenance.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters.

D. Install filter-gage, static-pressure taps upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum in accessible position. Provide filter gages on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to air-handling unit to allow service and maintenance.

C. Connect piping to air-handling units mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, ASTM B 88, Type M copper tubing. Extend to nearest equipment or floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping." Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.

F. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Air Duct Accessories."
3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Leak Test: After installation, fill water and steam coils with water, and test coils and connections for leaks.
   2. Charge refrigerant coils with refrigerant and test for leaks.
   3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Verify that shipping, blocking, and bracing are removed.
   3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
   4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
   5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
   6. Verify that zone dampers fully open and close for each zone.
   7. Verify that face-and-bypass dampers provide full face flow.
   8. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
   10. Verify that proper thermal-overload protection is installed for electric coils.
   11. Install new, clean filters.
   12. Verify that manual and automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:
   1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm. Replace fan and motor pulleys as required to achieve design conditions.
   2. Measure and record motor electrical values for voltage and amperage.
   3. Manually operate dampers from fully closed to fully open position and record fan performance.
3.6 ADJUSTING
   A. Adjust damper linkages for proper damper operation.
   B. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.7 CLEANING
   A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.8 DEMONSTRATION
   A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes cooling and heating rooftop replacement-air units.

1.2 SUBMITTALS
A. Product Data: Include rated capacities, furnished specialties, and accessories.
B. Shop Drawings: Include details of installation and wiring diagrams.
C. Coordination Drawings: Rooftop replacement-air units to roof-curb mounting 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. Size and location of rooftop replacement-air unit mounting rails and anchor points and methods for anchoring units to roof curb.
   2. Required roof penetrations for ducts, pipes, and electrical raceways, including size and location of each penetration.
D. Startup service reports.
E. Operation and maintenance data.
F. Warranty.

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. Units shall be designed to operate with HCFC-free refrigerants.

1.4 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components listed below that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
   2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
PART 2 - PRODUCTS

2.1 CABINET

A. Construction: Double wall.

B. Exterior Casing: Galvanized steel with baked-enamel paint finish with lifting lugs and knockouts for electrical and piping connections.

C. Interior Casing: Galvanized steel.

D. Base Rails: Galvanized-steel rails for mounting on roof curb.

E. Service Doors: Hinged access doors with neoprene gaskets.

F. Internal Insulation: Fibrous-glass duct lining complying with ASTM C 1071, Type II.
   1. Thickness: 1 inch (25 mm).
   2. Insulation Adhesive: Comply with ASTM C 916, Type I.
   3. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

G. Condensate Drain Pans: Formed sections of stainless-steel sheet designed for self-drainage. Fabricate pans with slopes to preclude buildup of microbial slime.

H. Roof Curb: Full-perimeter curb of sheet metal, 16 inches (400 mm) high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.

2.2 SUPPLY-AIR FAN

A. Fan: Forward-curved centrifugal; statically and dynamically balanced, galvanized or coated steel, mounted on solid-steel shaft with self-aligning, permanently lubricated ball bearings or pillow-block bearings rated L50 for 200,000 hours and having external grease fittings.

B. Motor: Open dripproof single-speed motor.

C. Drive: V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.4 service factor.

D. Mounting: Fan wheel, motor, and drives shall be mounted in fan casing with elastomeric or spring isolators.

2.3 REFRIGERATION SYSTEM

A. Fabricate and label refrigeration system to comply with ASHRAE 15, “Safety Code for Mechanical Refrigeration.”

B. Compressors: Scroll compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.

C. EER and COP: Meet or exceed minimum EER and COP values as defined by ASHRAE/IESNA 90.1, “Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.”
D. Refrigerant: R-407C or R-410A.

E. Refrigeration System Specialties:
   1. Expansion valve with replaceable thermostatic element.
   2. Refrigerant dryer.
   3. High-pressure switch.
   4. Low-pressure switch.
   5. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
   6. Brass service valves installed in discharge and liquid lines.
   7. Operating charge of refrigerant.

F. Capacity Control: Variable speed compressor or Hot-gas bypass refrigerant control for capacity control with continuous dehumidification on a single compressor.

G. Refrigerant Coils: Evaporator and condenser coils shall be designed, tested, fabricated, and rated according to ARI 410 and ASHRAE 33. Coils shall be leak tested under water with air at 315 psig (2170 kPa).
   1. Capacity Reduction: Circuit coils for face, row or interleaved control.
   2. Tubes: Copper.
   3. Fins: Aluminum.
   5. Suction and Distributor: Seamless copper tube with brazed joints.
   6. Coating: Phenolic epoxy corrosion-protection coating on both coils.
   7. Source Quality Control: Test to 450 psig (3105 kPa), and to 300 psig (2070 kPa) underwater.

H. Condenser Fan: Propeller type, directly driven by motor.

I. Safety Controls:
   1. Compressor motor and outside-coil fan motor low ambient lockout.
   2. Overcurrent protection for compressor motor and outside-coil fan motors.

2.4 INDIRECT-FIRED GAS FURNACE

   1. AGA Approval: Designed and certified by and bearing label of AGA.

B. Burners: Stainless steel with a minimum thermal efficiency of 80 percent.
   1. Fuel: Natural gas.
   2. Ignition: Electronically controlled electric spark with flame sensor.
   3. High-Altitude Kit: For Project elevations more than 2000 feet (610 m) above sea level.

C. Heat-Exchanger Drain Pan: Stainless steel.

D. Power Vent: Integral, motorized centrifugal fan interlocked with gas valve.

E. Safety Controls:
   1. Gas Control Valve: Electronic modulating.
2.5 OUTDOOR-AIR INTAKE AND DAMPERS

A. Dampers: Leakage rate, according to AMCA 500, shall not exceed 2 percent of air quantity at face velocity of 2000 fpm (10 m/s) through damper and pressure differential of 4-inch wg (1000 Pa).

B. Damper Operators: Electric.

C. Outdoor-Air Intake Hoods: Galvanized steel, with bird screen and finish to match cabinet.

2.6 FILTERS

A. Comply with NFPA 90A.

B. Disposable Panel Filters: 2-inch- (50-mm-) thick, pre-filters and 4-inch (100 mm) thick final filters, factory-fabricated, flat-panel-type, disposable air filters with holding frames, with a minimum efficiency report value of MERV 13 according to ASHRAE 52.2 and 90 percent average arrestance according to ASHRAE 52.1.

1. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
2. Frame: Galvanized steel.

2.7 CONTROLS

A. Factory-wire connection for controls' power supply.

B. Control devices, including sensors, transmitters, relays, switches, thermostats, humidistats, detectors, operators, actuators, and valves, shall be manufacturer's standard items to accomplish indicated control functions.

C. DDC Temperature Control: Stand-alone control module for link between unit controls and DDC temperature-control system. Control module shall be compatible with temperature-control system specified in Division 23 Section "Instrumentation and Control for HVAC".

2.8 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof curb on roof structure, according to NRCA's "Low-Slope Membrane Roofing Construction Details Manual," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure rooftop replacement-air units on curbs and coordinate roof penetrations and flashing with roof construction.

B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Install piping adjacent to machine to allow service and maintenance.
1. Gas Burner Connections: Comply with requirements in Division 23 Section "Facility Natural-Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union, pressure regulator, and shutoff valve with sufficient clearance for burner removal and service.

D. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to rooftop replacement-air units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

E. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

F. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.2 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for visible damage to furnace combustion chamber.
2. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
3. Inspect casing insulation for integrity, moisture content, and adhesion.
4. Verify that controls are connected and operable.
5. Clean outside coil and inspect for construction debris.
6. Clean furnace flue and inspect for construction debris.
7. Inspect operation of power vents.
8. Purge gas line.
10. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
11. Adjust fan belts to proper alignment and tension.
12. Start unit.
13. Start refrigeration system when outdoor-air temperature is within normal operating limits.
14. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
15. Operate unit for run-in period.
16. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:
   a. Measure gas pressure at manifold.
   b. Measure combustion-air temperature at inlet to combustion chamber.
   c. Measure flue-gas temperature at furnace discharge.
   e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.
17. Calibrate thermostats.
18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke.
20. Start refrigeration system and measure and record the following:
   a. Coil leaving-air, dry- and wet-bulb temperatures.
   b. Coil entering-air, dry- and wet-bulb temperatures.
   c. Outdoor-air, dry-bulb temperature.
   d. Outdoor-air-coil, discharge-air, dry-bulb temperature.
21. Verify operational sequence of controls.
22. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
   a. High-limit heat exchanger.
   b. Alarms.

B. After startup and performance testing, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not pass tests and inspections and retest as specified above.

D. Prepare written report of the results of startup services.

3.3 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain rooftop replacement-air units. Refer to Division 01 Section “Demonstration and Training.”

END OF SECTION 23 74 33
PART 1 - GENERAL

1.1 SUMMARY
A. This Section includes split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for exposed or concealed mounting, and may be connected to ducts.

1.2 SUBMITTALS
A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
B. 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.
C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
D. Units shall be designed to operate with HCFC-free refrigerants.

1.4 WARRANTY
A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within [five] <Insert number> years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EVAPORATOR-FAN UNIT
A. Concealed Unit Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
   1. Insulation: Faced, glass-fiber duct liner.
   2. Drain Pans: Galvanized steel, with connection for drain; insulated.
A. Side-Wall Exposed, Unit Cabinet – High-impact polystyrene or enameled steel with decorator styling.
2. Insulation: Faced, glass-fiber, duct liner.
3. Drain Pans: Galvanized steel, with connection for drain; insulated.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motor: Multispeed.

E. Filters: Permanent, cleanable.

2.2 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

1. Refrigerant Charge: R-407C or R-410A.

C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

E. Fan: Aluminum-propeller type, directly connected to motor.

F. Motor: Permanently lubricated, with integral thermal-overload protection.

G. Low Ambient Kit: and Winter Start Control: Permits operation down to -20 deg F (-28 deg C).

H. Crankcase heater.

I. Mounting Base: Polyethylene.

2.3 ACCESSORIES

A. Wired Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

C. Condensate removal pump and automatic controls.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install evaporator-fan components using manufacturer’s standard mounting devices securely fastened to building structure.

B. Install roof-mounted, compressor-condenser components on equipment supports specified in Division 07 Section “Roof Accessories.” Anchor units to supports with removable, cadmium-plated fasteners.

3.2 CONNECTIONS

A. Connect precharged refrigerant tubing to component’s quick-connect fittings. Install tubing to allow access to unit.

B. Install piping adjacent to unit to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections.

B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 23 81 26
PART 1 GENERAL

1.1 SUMMARY

A. Includes But Not Limited To
   1. General electrical requirements and procedures.
   2. Perform excavating and backfilling work required by work of this Division as described in Contract Documents.
   3. Furnish and install Penetration Firestop Systems at electrical system penetrations as described in Contract Documents.

B. Related Sections
   1. Division 31 - Criteria for performance of excavating and backfilling
   2. Division 07 - Quality of Penetration Firestop Systems to be used on Project

1.2 SUBMITTALS

A. Product Data
   1. Submit for following -
      a. Wiring devices
      b. Disconnects
      c. Panelboards
      d. Motor starters
      e. Lighting fixtures, poles, and associated control equipment
      f. Emergency lighting packs
      g. Signal bell system equipment
      h. Heating cable equipment
   2. Provide following information for each item of equipment -
      a. Catalog Sheets.
      b. Assembly details or dimension drawings.
      c. Installation instructions.
      d. Manufacturer's name and catalog number
      e. Name of local supplier.
   3. Do not purchase equipment before approval of product data.

B. Shop Drawings - Panelboards

C. Closeout
   1. Operations And Maintenance Manual Data -
      a. Modify and add to requirements of Section 01 77 00 as follows -
         1) Provide operating and maintenance instructions for each item of equipment submitted under Product Data.
         2) Include copy of approved shop drawings.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies
   1. NEC and local ordinances and regulations shall govern unless more stringent requirements are specified.
   2. Material and equipment provided shall meet standards of NEMA or UL, and bear their label wherever standards have been established and label service is available.

PART 2 PRODUCTS - Not Used
PART 3 EXECUTION

3.1 EXAMINATION

A. Confirm dimensions, ratings, and specifications of equipment to be installed and coordinate these with site dimensions and with other Sections.

3.2 INSTALLATION

A. Mounting Heights
   1. Unless otherwise indicated, mount center of outlets or boxes at following heights above finish floor:
      a. Temperature Control Junction Boxes - As indicated on Drawings
      b. Thermostats - As indicated on Drawings
      c. Remote Temperature Sensors - 56 inches to top
      d. Condensing Unit Disconnects - Top same height as top of unit
      e. Other Motor Disconnects - 60 inches
      f. Distribution Panels - 72 inches to top
      g. Receptacles - 18 inches
      h. Switches - 42 inches
      i. Wall-Mounted Exit Lights - 90 inches
      j. Telephone Board - 60 inches
      k. Telephones (desk type) - 18 inches
      l. Telephones (wall type) - 48 inches
      m. Sound / Satellite / TV Distribution System Components - As indicated on Drawings
      n. Push Buttons - 74 inches
      o. Bells - 86 inches
   2. Refer special conditions to Architect before rough-in and locate outlet under his direction.

B. Install Penetration Firestop System appropriate for penetration at electrical system penetrations through walls, ceilings, and top plates of walls.

3.3 FIELD QUALITY CONTROL

A. Site Tests - Test systems and demonstrate equipment as working and operating properly. Notify Architect prior to test. Rectify defects at no additional cost to Owner.

END OF SECTION
SECTION 26 05 19
BUILDING WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Building wire and cable.
   B. Wiring connectors and connections.

1.2 REFERENCES
   A. NECA Standard of Installation (National Electrical Contractors Association).
   C. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW
   A. Section 01 33 00 – Submittal Procedures.
   B. Product Data: Provide for each cable type.

1.4 SUBMITTALS FOR INFORMATION
   A. Section 01 33 00 – Submittals Procedures for submittals.
   B. Test Reports: Indicate procedures and values obtained.
   C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 SUBMITTALS AT PROJECT CLOSEOUT
   A. Section 01 78 39 – Project Record Documents.
   B. Project Record Documents: Record actual locations of components and circuits.

1.6 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS
   A. Conform to NFPA 70.
   B. Furnish building wire and wiring connectors listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 PROJECT CONDITIONS
   A. Verify that field measurements are as indicated.
B. Conductor sizes are based on copper.
C. Wire and cable routing indicated is schematic unless dimensioned.

1.9 COORDINATION
A. Where wire and cable destination is indicated and routing is not shown, determine exact routing and lengths required.

PART 2 - PRODUCTS

2.1 BUILDING WIRE
A. Description: Single conductor insulated wire.
B. Conductor: Copper.
C. Insulation Voltage Rating: 600 volts.
D. Insulation: NFPA 70, Type THHN-2/THWN-2.
E. Use standard color coding for phase A, phase B, phase C, neutral and ground: Insulation:
   1. 208/120 volt circuits: black, red, blue, white, green.
   2. 480/277 volt circuits: brown, orange, yellow, grey, green with white stripe.
   3. This color code shall be permanently posted at each panelboard and switchboard.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Verify that interior of building has been protected from weather.
B. Verify that mechanical work likely to damage wire and cable has been completed.
C. Verify that raceway installation is complete and supported.

3.2 PREPARATION
A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRING METHODS
A. Use wiring methods indicated.
B. All branch circuit and feeder wiring shall be installed in raceways.

3.4 INSTALLATION
A. Route wire and cable as required to meet Project Conditions.
B. Install cable in accordance with the NECA “Standard of Installation” and NFPA 70.
C. Use stranded conductors for power circuits.
D. Use stranded conductors for control circuits.
E. Use conductor not smaller than 12 AWG for power and lighting circuits.

F. Use conductor not smaller than 14 AWG for fused control circuits.

G. Unless a larger size is indicated on plans, use 10 AWG conductors for 20 ampere, 120 volt branch circuits with homeruns longer than 75 feet.

H. Unless a larger size is indicated on plans, use 10 AWG conductors for 20 ampere, 277 volt branch circuits with homeruns longer than 200 feet.

I. Pull all conductors into raceway at same time.

J. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

K. Neatly train and lace wiring inside boxes, equipment, and panelboards.

L. Clean conductor surfaces before installing lugs and connectors.

M. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

N. Use split bolt connectors for copper conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.

O. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.

P. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

Q. Identify and color code wire and cable under provisions of Section 16195. Identify each conductor with its circuit number or other designation indicated.

3.5 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.3.1.

3.6 INSULATION RESISTANCE TESTS

A. Perform tests after cables have been installed in raceways, but before connection to lugs. Notify Contracting Officer at least 14 days prior to cable tests.

B. Measure resistance line-to-ground using a commercial meggar tester. Apply 1000 volts DC to cables 2 AWG and larger and record DC insulation resistance for each circuit conductor. Minimum acceptable level is 50 megohms.

C. Record test results and include in O and M Manuals.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prefabricated flexible cable assemblies.
B. Distribution units.
C. Cable accessories.

1.2 REFERENCES


1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.
B. Shop Drawings: Indicate distribution box, switch box, outlet, and cable layout and branch circuit configuration.
C. Product Data: Provide for each cable type and for each fitting and accessory.
D. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
E. Provide voltage drop calculation showing wire size will support use per NEC guidelines.
F. Provide scaled drawings showing connection and cable requirements. Electronic drawing files may be obtained from engineer’s office. Request drawings minimum two weeks prior to need.

1.4 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 78 39 – Project Record Documents.
B. Record actual locations of cable assemblies and branch circuit arrangements.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 01 77 00 – Project Closeout.
B. Maintenance Data: Include replacement parts list.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years experience.

1.7 REGULATORY REQUIREMENTS
A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.9 COORDINATION

A. Furnish luminaire connectors to luminaire manufacturer for factory installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. AMP Inc.

B. Hubbell Wiring Devices

C. Siemens Co.

D. Light Fixture Manufacturer.

2.2 MANUFACTURED WIRING SYSTEMS

A. Cable Assemblies: Factory assembled units with appropriate connector on each end, with lengths and circuit configurations as required.

B. Voltage: 120 or 277 volts.

C. Switching Unit Assemblies: Cable assembly with 6 inch pigtail on one end. Provide cables configured for 3-way and 4-way switches where required.

D. Luminaire Connector Assemblies: Connector suitable for mounting in luminaire body knockout. At Contractor’s option, provide connector factory mounted in luminaire.

E. Accessories: Provide manufacturer’s standard accessories, including cable extenders, distribution tees, and switching assemblies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Products in accordance with manufacturer's instructions.

B. Support cable by means of straps and clamps.

C. Support cable minimum 24” above suspended ceiling to avoid contact with and interference with removal of ceiling panels.

D. Arrange cable to avoid interference with access to other work.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grounding electrodes and conductors.
B. Equipment grounding conductors.
C. Bonding.

1.2 REFERENCES

B. NFPA 70 - National Electrical Code.

1.3 GROUNDING SYSTEM DESCRIPTION

A. Metal underground water pipe.
B. Effectively grounded metal frame of the building.
C. Rod electrode.
D. Concrete – encased electrode.

1.4 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 5 ohms maximum.

1.5 SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittals Procedures for submittals.
B. Product Data: Provide for grounding electrodes and connections.

1.6 SUBMITTALS FOR INFORMATION

A. Section 01 33 00 – Submittals Procedures for information.
B. Test Reports: Indicate overall resistance to ground.
C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.7 SUBMITTALS FOR CLOSEOUT

A. Section 01 77 00 – Project Closeout for submittals.
B. Record actual locations of components and grounding electrodes.
1.8 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.9 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 ROD ELECTRODES
A. Material: Copper-clad steel.
B. Diameter: 3/4 inch.
C. Length: 10 feet.

2.2 MECHANICAL CONNECTORS
A. Manufacturers: Burndy or approved equal.
B. Material: Bronze.

2.3 EXOTHERMIC CONNECTIONS
A. Manufacturers: Cadweld or approved equal.

2.4 WIRE
A. Material: Stranded copper. Unless noted otherwise, provide with green insulation.
B. Size: As required by NEC.

2.5 GROUND BUSHING/LUG
A. Insulated metallic grounding bushings, tin-plated open-type lug dual rated for CU-AL conductors, thermoplastic liners rated 105 degree C, die cast zinc, to provide a smooth, well-rounded bearing surface for wires or cable at the end of threaded conduit or a conduit connector as required by the NEC.

2.6 ISOLATED GROUNDING CONDUCTORS
A. Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor at both ends of conductors and at any boxes or splice locations with alternating bands of green and yellow tape. Provide at least three bands of green and two bands of yellow tape.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 INSTALLATION

A. Install rod electrodes at exterior of building near service equipment. Install additional rod electrodes as required to achieve specified resistance to ground.

B. Provide 3/0 AWG bare copper grounding electrode conductor and connect to reinforcing steel in foundation footing. Bond steel together using tie wires so there is a minimum of 40 feet of continuous bar to which to bond grounding electrode conductor.

C. Provide 3/0 AWG bare copper grounding electrode conductor and connect to metal cold water pipe. Metal cold water pipe must be in continuous direct contact with the earth a minimum of 10 feet. Make connection a maximum of 5 feet from the point of entrance to the building.

D. Provide bonding to meet Regulatory Requirements.

E. In addition to bonded equipment grounding conductors, provide isolated grounding conductors for circuits shown on plans. Conductors shall be 12 AWG unless noted otherwise and one per circuit.

F. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

G. Where multiple ground terminal strips are provided with new panels, run solid bare #8AWG between all ground terminal strips.

3.3 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports.
B. Anchors and fasteners.

1.2 REFERENCES

A. NECA - National Electrical Contractors Association.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
B. Product Data: Provide manufacturer’s catalog data for fastening systems.
C. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.
B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.
C. Anchors and Fasteners:
   1. Concrete Structural Elements: Use precast insert system or expansion anchors and preset inserts.
   2. Steel Structural Elements: Use beam clamps or welded fasteners.
   5. Solid Masonry Walls: Use expansion anchors and preset inserts.

2.2 STEEL CHANNEL
A. Manufacturer: Unistrut (P1000 unless otherwise noted) or approved equal.

B. Description: Galvanized or painted steel. (1-5/8” square.)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation" and NFPA 70.

C. Do not fasten supports to pipes, ducts, mechanical equipment, ceiling support wires, and conduit.

D. Do not use spring steel clips and clamps.

E. Do not use powder-actuated anchors.

F. Do not drill or cut structural members.

G. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

H. Install surface-mounted cabinets and panelboards with minimum of four anchors.

I. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.

J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION
SECTION 26 05 33
CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Metal conduit.
B. Flexible metal conduit.
C. Liquidtight flexible metal conduit.
D. Electrical metallic tubing.
E. Nonmetallic conduit.
F. Flexible nonmetallic conduit.
G. Fittings and conduit bodies.

1.2 RELATED SECTIONS
A. Section 07 62 00 – Flashing and Sheet Metal.
B. Section 07 84 22 – Firestopping.
C. Section 26 05 43 – Underfloor Ducts.
D. Section 26 05 34 – Boxes.
E. Section 26 05 26 – Grounding and Bonding.
F. Section 26 05 29 – Supporting Devices.
G. Section 26 05 53 – Electrical Identification.

1.3 REFERENCES
A. Conduit and tubing shall meet the requirements of the latest editions of following standards:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.
   3. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   5. NECA "Standard of Installation."
   6. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.4 DESIGN REQUIREMENTS
A. Conduit Size: ANSI/NFPA 70. Limit conductor cross sectional area to no more than 40% of conduit cross sectional area.
1.5 SUBMITTALS
A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
B. Product Data: Provide for metallic conduit, flexible metal conduit, liquid tight flexible metal conduit, metallic tubing, nonmetallic conduit, fittings, conduit bodies.

1.6 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01 78 39 – Project Record Documents.
B. Accurately record actual routing of interior conduits larger than 2 inches on project record documents and of all underground conduits regardless of size. For locations of underground conduits provide dimensions indicating locations and depth.

1.7 REGULATORY REQUIREMENTS
A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.8 DELIVERY, STORAGE, AND HANDLING
A. Accept conduit on site. Inspect for damage.
B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
C. Protect PVC conduit from sunlight.

1.9 PROJECT CONDITIONS
A. Verify that field measurements are as shown on Drawings.
B. Verify routing and termination locations of conduit prior to rough-in.
C. Conduit routing is shown schematically on Drawings unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.1 CONDUIT REQUIREMENTS
A. Minimum Size: 3/4” inch unless otherwise specified.
B. Non-Hazardous Underground Installations:
   1. More than Five Feet outside Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated rigid steel conduit or thickwall nonmetallic (Schedule 40 PVC) conduit.
   2. Within Five Feet Inside Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated rigid steel conduit or thickwall nonmetallic (Schedule 40 PVC) conduit.
   3. Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, plastic coated rigid steel conduit or thickwall nonmetallic (Schedule 40 PVC) conduit.
C. Outdoor Locations, Above Grade: Use rigid steel or intermediate metal conduit.

D. Wet and Damp Interior Locations Above Floor Slab: Use rigid steel conduit, intermediate metal conduit or electrical metallic tubing. Use wet and/or damp location fittings.

E. Dry Interior Locations Above Floor Slab (Including Hollow Stud Partitions):
   1. Concealed: Use rigid steel, intermediate metal conduit or electrical metallic tubing.
   2. Exposed: Use rigid steel, intermediate metal conduit or electrical metallic tubing.

2.2 METAL CONDUIT
   A. Rigid Steel Conduit: ANSI C80.1.
   B. Intermediate Metal Conduit (IMC): Rigid steel.
   C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit, threaded connections.

2.3 PVC COATED METAL CONDUIT
   A. Description: NEMA RN 1; rigid steel conduit with external PVC coating, 40 mil thick.
   B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.4 FLEXIBLE METAL CONDUIT
   A. Description: Interlocked steel construction.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT
   A. Description: Interlocked steel construction with PVC jacket.

2.6 ELECTRICAL METALLIC TUBING (EMT)
   A. Description: ANSI C80.3; galvanized tubing.
   B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type or set screw type.

2.7 NONMETALLIC CONDUIT
   A. Description: NEMA TC 2; Schedule 40 PVC.
   B. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Install conduit in accordance with NECA "Standard of Installation" and NFPA 70.
B. Install nonmetallic conduit in accordance with manufacturer's instructions and NFPA 70.

C. Arrange supports to prevent misalignment during wiring installation.

D. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers. Where possible, support conduits in ceiling cavity space at the level of structural roof joists.

E. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each rack for 25 percent additional conduits.

F. Fasten conduit supports to building structure and surfaces under provisions of Section 16190. DO NOT SUPPORT CONDUITS DIRECTLY FROM ROOF DECK.

G. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

H. Do not attach conduit to ceiling support wires. Fasten individual conduits to roof joists.

I. Arrange conduit to maintain headroom and present neat appearance.

J. Route exposed conduit parallel and perpendicular to walls.

K. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

L. Route conduit under slab directly from point-to-point where possible. Avoid conduit crossovers where possible.

M. Do not install conduit in floor slab on grade or floor slab above grade. Run conduits 1-1/2” and below on grade at bottom of gravel sub-base. Conduits larger than 1-1/2” shall be trenched in below grade so top of conduit is at top of grade.

N. Maintain minimum 6-inch clearance between conduit and piping.

O. Maintain 12 inch clearance between conduit and surfaces with temperatures exceeding 104 degrees F.

P. Cut conduit square using saw or pipe cutter; de-burr cut ends before joining.

Q. Bring conduit to shoulder of fittings; fasten securely.

R. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum. Use only an approved hotbox bender to make bends in nonmetallic conduit.

S. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

T. Install no more than equivalent of three 90-degree bends between boxes (no more than two 90-degree bends for conduits containing telephone cables, fire alarm cables, intrusions system cables, local area network (LAN) cables, etc.). Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate factory elbows for bends in metal conduit larger than 2 inch size.
U. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

V. Provide expansion/deflection couplings to accommodate expansion and deflection where conduit crosses seismic joints or expansion joints. Such couplings shall have braided copper bonding jumpers.

W. Provide suitable pull string in each empty conduit except sleeves less than 20 feet long and nipples.

X. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

Y. Ground and bond conduit under provisions of Section 26 05 26.

Z. Identify conduit under provisions of Section 26 05 53.

AA. Where conduits for telephone cables, cash register cables, etc. are stubbed from wall boxes or cabinets to above accessible ceilings, turn conduits out of wall approximately 12 inches above accessible ceiling. Coordinate location with other trades. Provide bushing on end of conduit to prevent signal cable contact with sharp metal. Provide tag on end of conduit indicating type and location of utilization outlet (example: TELEPHONE - BREAK ROOM).

BB. In interior locations, turn nonmetallic conduits through floor slab using rigid steel elbows. Continue raceway above floor slab using metallic conduit.

CC. Where conduits turn up into switchboard, padmount transformer or large utilization equipment, provide grounding bushings on ends of conduits, and bond to equipment grounding terminal strip or lugs using bonding jumper sized according to NFPA 70.

DD. Where conduits enter boxes and cabinets, provide bushings with plastic insulated throat for conduits 1 inch and larger.

EE. Seismic Bracing: provide seismic bracing for suspended conduits 2” or larger and trapeze hangers at interval of 20 feet or less. Bracing shall consists of 1-5/8” square channel both parallel and perpendicular to conduit, and fastened to roof joist at 45 degree angle relative to vertical.

FF. AC and MC cable shall not be acceptable for use on this project, except as specified in 26 05 24.

GG. Paint exposed conduit to match adjacent surface.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Section 07 84 00.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall and ceiling outlet boxes.
B. Floor boxes.
C. Pull and junction boxes.

1.2 REFERENCES

A. NECA - Standard of Installation.
B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.
C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
D. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submittals under provisions of Section 01 33 00.
B. Product Data: Provide dimensions, materials, and accessories.

1.4 SUBMITTALS FOR CLOSEOUT

A. Section 01 77 00 – Project Closeout.
B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.
B. Cast Boxes: NEMA FB 1, Type FD, cast ferroloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 27 26.

D. Weatherproof exterior boxes to house receptacles: Receptacle shall be installed recessed into wall. The receptacle cover shall have ports to allow two 3/8” diameter cords to pass through and must not protrude over 1/2” from wall surface. Recessed enclosure must have gasket between enclosure and mounting surface and between cover and sleeve to assure that the enclosure is weathertight in use per NEC 410-57b. Taymac “Masque”, Intermatic “Flexi-Guard” or equal. **Failure to provide devices will result in removal and reinstallation per specification at Contractors expense.**

2.2 FLOOR BOXES

A. Floor Boxes: NEMA OS 1, fully adjustable 3.75 inches deep.

B. Material: Cast metal.

C. Shape: Rectangular.

D. Service Fittings: As specified in Section 26 27 26.

2.3 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 05 35.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 6; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, inside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron.
   2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: “ELECTRIC” or “TELEPHONE” as appropriate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify locations of floor boxes and outlets in prior to rough-in. Where available, use dimensional data to locate boxes.

3.2 INSTALLATION

A. Install boxes in accordance with NECA “Standard of Installation.”

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
C. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

D. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet if required to accommodate intended purpose.

E. Orient boxes to accommodate wiring devices as specified in Section 26 27 26.

F. Maintain headroom and present neat mechanical appearance.

G. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

H. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

I. Install boxes to preserve fire resistance rating of partitions and other elements.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

K. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

L. Unless otherwise indicated on plans, align adjacent wall mounted outlet boxes for switches, manual starters, thermostats, and similar devices. Align wall mounted boxes for receptacles, telephone jacks, local area network outlets, and the like. Where such devices are shown in close proximity on plans, locate adjacent outlets with no more than 4 inch space between adjacent boxes.

M. Use flush mounting outlet boxes in all areas except mechanical rooms, mezzanines, and electrical closets.

N. Unless otherwise indicated on plans, locate flush mounting boxes in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

O. Do not install flush mounting boxes back-to-back in walls; provide minimum 6 inches separation.

P. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. After finished wall material is applied, provide box extensions for all boxes with setback more than 1/8 inch.

Q. Use stamped steel bridges to fasten flush mounting outlet box between studs.

R. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

S. Use adjustable steel channel fasteners for hung ceiling outlet box.

T. **DO NOT FASTEN BOXES TO CEILING SUPPORT WIRES OR DIRECTLY TO ROOF DECK.**

U. Support boxes independently of conduit.

V. Use gang box where more than one device is mounted together. Do not use sectional box. Provide metal barrier plates between gangs to separate line voltage from low voltage systems and where voltage between adjacent light switches exceeds 300 volts.
W. Use 4" square box with plaster ring for single device outlets.

X. Use cast outlet box in exterior locations exposed to the weather, interiors of walk-in refrigeration equipment, and wet locations. Provide vapor seals at conduit entrances to these boxes. Use UL listed sealing compound.

Y. Use cast floor boxes for installations in slab on grade.

Z. Set floor boxes level. Recheck level and elevation immediately after concrete pour and rough finish. Where floor boxes for power, telephone, and intrusion detection system occur together, insure these boxes are spaced so as to be completely covered by store fixtures.

AA. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

BB. Where fossil fuel driven vehicles, appliances, or equipment including lawn equipment in Lawn Storage Room are present, locate all boxes at least 36 inches above floor level. Feed such boxes with cable and conduit from above. Allow no electrical work to penetrate the space from floor level to 18 inches above floor.

CC. Provide pull boxes in feeder circuits as required but at least every 150 feet in straight runs.

DD. Identify all junction boxes by panel and circuit number on outside cover with legible permanent ink marker.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Coordinate installation of outlet box for equipment connected to allow accessibility of box and proper operation of equipment.

3.4 ADJUSTING

A. Adjust floor box covers to be flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

D. Seal floor boxes as recommended by manufacturer.

3.5 CLEANING

A. Section 01 71 00 – Cleaning: Clean installed work.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

D. Check boxes for the presence of drywall screws, concrete residue, and sharp other objects. Remove all sharp objects.

E. Clean floor boxes and underfloor conduit systems of water and dirt prior to installing wiring. Close boxes to prevent entry of dirt and water after installing wires. Failure to meet this requirement will result in contractor being required to remove wiring, clean boxes and conduit systems and reinstallation of new wiring, all at no cost to AAFES.
SECTION 26 05 35
CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Hinged cover enclosures.
B. Cabinets.
C. Terminal blocks.
D. Accessories.

1.2 REFERENCES
A. NECA Standard of Installation (National Electrical Contractors Association).
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
C. NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.
D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW
A. Section 01 33 00 – Submittals Procedures for submittals.
B. Product Data: Provide manufacturer's standard data for enclosures and cabinets.

1.4 SUBMITTALS FOR INFORMATION
A. Section 01 33 00 – Submittals Procedures for information.
B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by Underwriters Laboratories, Inc.

1.6 MAINTENANCE MATERIALS
A. Section 01 78 39 – Project Record and Section 01 77 00 Project Closeout.
B. Furnish two of each key. Cabinets and enclosures shall be keyed to same key as panel boards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Hoffman  
B. Square D  
C. General Electric  

2.2 HINGED COVER ENCLOSURES  

A. Construction: NEMA 250, Type 1 inside, or 3R where exposed to weather or moisture, steel enclosure.  
B. Covers: Continuous hinge, held closed by flush latch operable by key. Covers in damp and wet locations shall have continuous gasket.  
C. Provide removable interior metal panel for mounting terminal blocks and electrical components; finish with white enamel. Provide standoff devices for separation of equipment mounting panel from enclosure.  
D. Enclosure Finish: Manufacturer’s standard enamel.  

2.3 CABINETS  

A. Boxes: Galvanized steel.  
B. Backboard: Provide white enamel finished metal backboard for mounting terminal blocks or other devices.  
C. Fronts: Steel, Flush type with door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.  
D. Provide metal barriers to form separate compartments wiring of different systems and voltages.  
E. Provide accessory feet for free-standing equipment.  

PART 3 - EXECUTION  

3.1 INSTALLATION  

A. Install in accordance with NECA "Standard of Installation" and NFPA 70.  
B. Install enclosures and boxes plumb. Anchor securely to wall and structural supports at each corner under the provisions of Section 16190.  
C. Install cabinet fronts plumb.  

3.2 CLEANING  

A. Section 01 71 00 – Cleaning: Clean installed work.  
B. Clean electrical parts to remove conductive and harmful materials.  
C. Remove dirt and debris from enclosure.  
D. Clean finishes and touch up damage.
SECTION 06 05 36
CABLE TRAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Cable trays and accessories.

1.2 RELATED SECTIONS
A. Section 26 05 33 – Conduit.
B. Section 26 05 34 – Boxes.
C. Section 26 05 26 – Grounding and Bonding for Electrical Systems.
D. Section 26 05 26 – Supporting Devices.

1.3 REFERENCES

1.4 SUBMITTALS
A. Submit the following according to Section 01 33 00:

1. Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

2. Shop Drawings: For each type of cable tray.
   a. Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
   b. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer.
      1) Design Calculations: Calculate requirements for selecting seismic restraints.
      2) Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

3. Coordination Drawings: Floor plans and sections drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural and mechanical elements. Show the following:
   a. Vertical and horizontal offsets and transitions.
   b. Clearances for access above and to side of cable trays.
   c. Vertical elevation of cable trays above floor or bottom of ceiling structure.

4. Product Certificates: For each type of cable tray, signed by product manufacturer.

5. Manufacturer Seismic Qualification Certification: Submit certification that cable trays, accessories, and components will withstand seismic forces at Kirtland AFB.
a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   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."

b. Dimensioned Outline Drawings of Cable Tray Units: Identify center of gravity and locate and describe mounting and anchorage provisions.

c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

7. Operation and Maintenance Data: For cable trays to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE
A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

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 NEMA VE 1, "Metal Cable Tray Systems," if cable tray types specified are defined in the standard.

D. Comply with NFPA 70.

1.6 COORDINATION
A. Coordinate layout and installation of cable trays and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, loudspeakers, HVAC equipment, fire-suppression system, and partition assemblies.

1.7 DELIVERY, STORAGE AND HANDLING
A. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors protected from damage, and in accordance with manufacturer’s instructions.

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. B-Line Systems, Inc.
2. Chalfant Cable Trays.
3. GS Metals Corp.
5. MPHusky.
6. P-W Industries, Inc.
7. Thomas & Betts Corporation.
8. Cablofil, Inc.
2.2 CABLE TRAY

A. Description: Continuous, flex basket cable tray system.
   2. Wire Mesh: Welded at all intersections.
   3. Safety Edge: Continuous safety edge T-welded wire up.

B. Nominal Dimensions:
   1. Mesh: 2 x 4 inches.
   2. Straight Section Length: 80 inches and 118 inches.
   3. Width: as indicated on plans.
   4. Depth: as indicated on plans.
   5. Wire Diameter: 0.177 inch minimum.

C. Fittings: Field fabricated in accordance with manufacturer's instructions from straight sections.

D. Support System:
   1. Trapeze Mounting to Structure: CS Profile.
   2. Fasteners: Furnished by manufacturer.
   3. Seismic Supports: Aircraft cable seismic support system furnished by manufacturer. Cablofil “SZMCKIT” seismic bracing kit or equal.

E. Hardware: Hardware, including splice connectors and support components furnished by manufacturer.

2.3 ACCESSORIES

A. Grounding: GTA-2-3 grounding lugs for attachment on tray of continuous ground conductor fixing system.

B. Fittings: Tees, crosses, risers, elbows and other fittings as indicated, of same materials and finishes of cable tray.

2.4 SOURCE QUALITY CONTROL

A. Perform design and production tests according to NEMA VE 1.

PART 3 - EXECUTION

3.1 INTERFERENCES

A. Coordinate work with other trades so that interference between piping, ductwork equipment, structural and electrical work will be avoided.

B. When interference develops, Architect/Engineer will decide which equipment will be relocated; regardless of which apparatus was installed first.

3.2 EXAMINATION

A. Examine areas to receive cable tray. Notify the Architect/Engineer of conditions that would adversely affect the installation or subsequent utilization of the system. Do not proceed with installation until unsatisfactory conditions are corrected.
3.3 INSTALLATION

A. Install cable tray at locations indicated on the drawings and in accordance with manufacturer’s instructions.

B. Load Span Criteria: Install and support cable tray in accordance with span load criteria of L/240.

C. Cutting:
   1. Cut wires in accordance with manufacturer’s instructions.
   2. Cut wires with side action bolt cutters to ensure integrity of galvanic protective layer.
   3. Cut each wire with 1 clean cut to eliminate grinding or touch-up.
   4. Remove burrs and sharp edges from cable tray.

D. Install cable tray using hardware, splice connectors, support components, and accessories furnished by manufacturer.

E. Use expansion/deflection connectors where trays cross building expansion joints, seismic joints or in runs that exceed 90ft. space connections and set gaps according to NEMA VE 1.

F. Provide fire stop fittings with intumescent material to sustain ratings where passing cable tray through fire-rated elements. Provide multiple fittings as required to provide opening approximately same dimensions as cable tray.
   1. STI “EZ Path”.
   2. Wiremold “Flame Stopper”.
   3. Approved equal.

G. Ground and bond cable tray under provisions of Section 16170.
   1. Provide continuity between tray components.
   2. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
   3. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component.

H. Provide lateral and longitudinal seismic bracing of cable trays at intervals of 20 feet or less. Bracing shall consist of 1-5/8 inch square steel channel mounted at a 45 degree angle (relative to vertical) and both parallel and perpendicular to the cable trays. Fasten bracing to structural roof joists and beams.

I. Make changes in direction and elevation using standard fittings.

J. Sleeves for Future Cables: Provide capped sleeves for future cables through firestop. Sealed cable tray penetrations of fire and smoke barriers.

K. Workspace: Provide cable trays with sufficient space to permit access for installing cables.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:
   1. After installing cable trays and after electrical circuitry has been energized, test for compliance with requirements.
   2. Perform the following electrical test and visual and mechanical inspections:
      a. Visually inspect each cable tray joint and each ground connection for mechanical continuity.
      b. Measure ground resistance of each system of cable tray from the most remote element to the point where connection is made to service disconnect enclosure grounding terminal. Record resistance in ohms.
3.5 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure cable tray is without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION
SECTION 26 05 43
UNDERFLOOR DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Underfloor ducts.

1.2 SUBMITTALS
A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
B. Shop Drawings: Indicate layout, insert spacing and height, locations of fittings and accessories, and overall dimensions.
C. Product Data: Provide data showing component details, dimensions, and finishes.
D. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.3 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01 78 39 – Project Record Documents.
B. Record actual locations of ducts, service fittings, junction boxes, and branch circuiting arrangements. Give dimensional data referenced to column lines.

1.4 OPERATION AND MAINTENANCE DATA
A. Submit under provisions of Section 01 77 00 – Project Closeout.
B. Maintenance Data: Instructions for locating inserts and installing after set inserts.
C. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years documented experience.

1.5 REGULATORY REQUIREMENTS
A. Conform to requirements of ANSI/NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.6 FIELD MEASUREMENTS
A. Verify that field measurements are as indicated.

1.7 EXTRA MATERIALS
A. Provide five afterset inserts.
B. Provide one of each special tool required to locate preset inserts.
C. Provide one of each special tool required to install afterset inserts.

D. Turn extra materials over to Contracting Officer, obtain hand receipt. Include hand receipt with O & M manual.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

A. Wiremold.

2.2 UNDERFLOOR DUCT

A. Description: Steel duct with corrosion-resistant finish.

B. Type: Underfloor.

C. Configuration: One level system using ducts in parallel runs as shown on Drawings.

D. Service: 120 volt power, or as indicated on drawings.

E. Standard Size: 1.5 x 3 inches nominal.

F. Extra Width Size: 1.5 x 6 inches nominal.

G. Inserts: Fabricate distribution lengths with one inch high preset inserts on 12 inch centers.

H. Single Level Junction Boxes: Cover and trim, adjustable height. Provide internal barriers, conduit and duct entrances, and extension rings as required.

I. Two Level Junction Boxes: Cover and trim, adjustable height; separate enclosures for each service to allow feeder ducts to cross under distribution ducts. Provide conduit and duct entrances and extension rings as required.

J. Junction Box Cover Plate: Provide heavy gauge metal. In areas with tile floors, provide trim plate flush with floor. In carpeted areas, provide carpet trim holders.

K. Supports: Adjustable before concrete topping placement.

L. Service Fittings: As specified in Section 26 27 26 and this section.

M. Duct Markers: Corrosion resistant marker screws with escutcheon.

N. Fittings and Accessories: Manufacturer's standard.

2.3 SERVICE FITTINGS AND DUCT ACCESSORIES

A. Provide all required fittings and accessories for a complete underfloor duct system whether or not specified or shown on drawings.

B. Fittings and accessories shall include:

1. Flush power receptacle (not for use in checkstands; see subparagraph 3 below): NEMA 5-15R white receptacle, insert adapter, and beveled brass top plate with screw plug. Mount adapter and receptacle in throat of duct insert. Provide brass split bell cap to protect cord plugcaps.
2. Flush communications outlets for telephone, local area network (LAN), and intrusion detection system takeoffs: Insert adapter, brass top plate with screw plug and split bell cap.

3. Power takeoff outlets serving receptacles mounted in checkstands: Insert adapter, brass top plate with 3/4" diameter screw plug, flexible conduit connector, and 3/4" flexible conduit to outlet box in checkstand.

4. Support couplers: Heavy gauge metal with leveling legs, and separators to insure at least one inch separation between adjacent ducts.

5. Standard supports: Heavy gauge metal with leveling legs.

6. Marker screw fittings: Provide in last insert in each duct run. Screw shall be flush with carpet or tile. Provide with escutcheon plate.

7. Takeoff "Y" fittings: Use for conduit takeoffs from within duct run. Provide 45 degree takeoff fittings with flanged end connectors.

8. Conduit adapters: Provide adapters which match duct cross section and provide two 1-1/4" conduit takeoffs. Provide reducers where smaller conduits are used.

9. Miscellaneous fittings: Provide all required fittings including end caps, horizontal and vertical elbows, flanged cabinet connectors, and expansion couplings.

C. Tops of outlet trim plates shall be flush with finished floor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. **Install ducts in thickened floor slabs no less than 6" thick.** Coordinate this requirement with other trades. Bend steel reinforcing in floor slab so that it is below floor duct.

C. Provide expansion fittings with suitable bonding jumper where duct crosses building expansion joints or seismic joints.

D. Terminate ducts for power service in bottom of panelboard or wireway using suitable fittings; in junction box for extension of conduit to panelboard.

E. Level junction box and fitting cover plates flush with finished concrete floor.

F. Place rectangular plates square with wall lines.

G. Securely hold junction boxes and ducts in place during installation to avoid floating or other movement.

H. Close unused duct or conduit entrances to junction boxes. Seal duct terminations at junction boxes.

I. Ground and bond duct under provisions of Section 26 05 26.

J. Install underfloor duct with tops of preset inserts 1 inch below finished floor line. Provide metal, screw type extension fittings where required to bring utilization fittings flush with floor.

K. Support Couplers and Supports: Join duct lengths using combination support couplers where practical. Provide additional supports at intervals of not over 5 feet, within 30 inches each side of junction boxes, and as close as practical to elbows, bends, and terminations.
L. Install insert within 6 inches of edge of junction box. Align inserts on same centers for all services.

M. Install a duct marker in each insert adjacent to junction box, at end of each duct run, on both sides of permanent partitions, and on both sides of change of direction of duct. Install markers flush with finished floor material. In carpeted areas, install marker screws level with carpet backing.

N. Clean ducts and fittings of debris and dust before installing wire and cable.

O. Pull wire and cable from outlet insert toward junction boxes.

P. Make all cuts and splices above floor within boxes in checkstands. Do not splice within duct inserts.

Q. Provide two nylon pull strings from last insert in each run to termination of duct run.

3.2 CLEANING

A. Clean installed work. Do not install conductors until ducts have been thoroughly cleaned of water and dirt. Failure to meet this condition will result in contractor being required to remove wiring completely, clean ducts, and provide new conductors, all at no cost to AAFES.

B. Clean finished surfaces in accordance with manufacturer’s instructions.

3.3 PROTECTION

A. Protect boxes, covers, and rings from distortion and finish damage.

B. Replace boxes, covers, and rings marred during construction.

END OF SECTION
SECTION 26 05 53  
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Nameplates.
   B. Wire and cable markers.
   C. Conduit markers.

1.2 REFERENCES

1.3 SUBMITTALS
   A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
   B. Product Data: Provide catalog data for nameplates, labels, and markers.
   C. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.4 REGULATORY REQUIREMENTS
   A. Conform to requirements of ANSI/NFPA 70.
   B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES
   A. Nameplates: Engraved three-layer laminated plastic, white letters on black background. Screw on type with two self tapping screws. Mastic type nameplates not allowed.
   B. Locations:
      1. Main disconnect switch (indicate maximum allowable fuse size where fuse is smaller than switch ampere rating).
      2. Each switch in switchboard.
      3. Each lighting and appliance panelboard.
      4. Each breaker in distribution panels L1, L2, and L3.
      7. Relays and contactors. Indicate loads controlled.
      8. Time switches. Indicate load controlled.
      9. Fire alarm annunciators and local operators consoles (LOC’s).
10. Transformers.
11. Where more than two switches are located adjacent to each other or when switches control loads not in same space.
12. Where noted on plans.

C. Letter Size:
   1. Use 1/8 inch letters for identifying individual equipment and loads such as safety switches, motor starters, and relays.
   2. Use 1/4 inch letters for identifying grouped equipment and loads such as panelboards, switchboards, and motor control centers.

2.2 WIRE MARKERS
   A. Description: Cloth, tape, split sleeve, or tubing type wire markers.
   B. Locations: Each conductor at distribution equipment panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.
   C. Legend:
      1. Power and Lighting Circuits: Branch circuit or feeder circuit number.
      2. Control Circuits: Control wire number corresponding to applicable control schematics.

2.3 CONDUIT MARKERS
   A. Location: Furnish markers for each conduit longer than 6 feet. At contractor option provide pre-colored conduit. Allied “True Color” or equal.
   B. Spacing: 10 feet on center. Minimum 4” band.
   C. Color:
      1. 480 Volt System: Orange.
      2. 208 Volt System: Silver.
      5. Emergency: Red.

2.4 UNDERGROUND WARNING TAPE
   A. Description: 6 inch wide plastic tape, detectable type, A.P.W.A. colored tape with suitable warning legend describing buried electrical lines. Detection shall be by means of continuous integral metal conductor factory installed in warning tape.
      2. Orange – “Caution Buried Telephone Line Below.”

PART 3 - EXECUTION

3.1 PREPARATION
   A. Degrease and clean surfaces to receive nameplates.

3.2 APPLICATION
A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using screws.

C. Identify conduit using field painting under provisions of Section 09910.

D. Paint colored band on each conduit longer than 6 feet and conduit stubs.

E. Paint bands 20 feet on center, minimum 4” band.

F. Color:
   1. 480 Volt System: Orange.
   2. 208 Volt System: Silver.
   5. Emergency: Red
   6. Comm/Data: Blue

G. Identify underground conduits using underground warning tape. Install one tape per trench at 12 inches above conduits or duct bank.

END OF SECTION
SECTION 26 09 23
ELECTRIC CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Time switches.

1.2 RELATED SECTIONS
   A. Section 26 05 35 - Cabinets and Enclosures.
   B. Section 26 29 24 - Enclosed Contactors.

1.3 REFERENCES
   A. NEMA ICS 1 - General Standards for Industrial Control Systems.
   B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
   C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
   D. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS
   A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
   B. Product Data: Provide for each component showing electrical characteristics and connection requirements.
   C. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
   A. Conform to requirements of NFPA 70.
   B. Furnish Products listed and classified by Underwriters Laboratories, Inc.

PART 2 - PRODUCTS

2.1 TIME SWITCHES
   A. Time switches shall be seven day plus 365 day solid state electronic type, capable of independent programming of two (2) independent channels, with programmable automatic daylight savings time adjustment, and shall be housed in a lockable, non-metallic, surface mount case.
   B. Switches shall be capable of fully independent 7 day scheduling, with up to 3 ON and 3 Off times
per channel per day, plus a special 365 holiday schedule, assigned by month and day.

C. They shall be capable of independent duty cycling during the scheduled ON time, with up to 3 patterns per channel per day and built-in 5 minute short cycle protection.

D. They shall have independent timed override for each channel for manual control and be programmable independently per channel per day, from 1 minute to 23 hours and 59 minutes.

E. Switches shall have brown-out protection and automatic 4 second load staggering when channels are programmed to be ON at the same time or after power outages and shall be equipped with a rechargeable carry-over system for up to 14 hours of carry-over. Switches shall perform a self-test every 60 seconds to assure a fail-safe operation.

F. Time switches shall be powered by a 120VAC, 60HZ source. Contact configuration to be N.O. (N.C.) for each channel, with a rating of 15 amperes ballast, 120/240/277VAC. Contact closure on time switch shall be momentary for pilot control of mechanically held contactors and relays.

G. Manufacturers for time switches:
   1. Time Switch: Tork #DZM200A for two channel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment according to manufacturer's written instructions.

B. Train and lace wiring in cabinets.

C. Program time switches according to instructions from Contracting Officer.

D. Label each time switch with engraved nameplate.

E. Label each time switch load contact indicating contactors controlled by each load contact.

F. Provide two hours training of AAFES personnel in programming operations.

G. Provide programming module and PC based software for programming of time switch. Turn module program and software instructions over to AAFES at completion of project. Obtain hand receipt and include with O & M manuals.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical trade provide:
   1. Occupancy sensors for lighting control.

1.2 RELATED SECTIONS

A. Section 26 05 33 - Conduit.
B. Section 26 05 19 - Building Wire and Cable.
C. Section 26 05 34 - Boxes.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. In accordance with Section 01 33 00 – Submittal Procedures, provide:
   1. Product Data: Provide electrical ratings, adjustment ranges, enclosure type, outline dimensions, mounting dimensions, and terminal connection information.
   2. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.
   3. CAD generated lighting plans for each building marked by occupancy sensor manufacturer showing proper product, location, and orientation of each sensor.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 SENSORS

A. Ceiling mounted dual technology sensors shall employ both passive infrared and ultrasonic detection methods. Sensors shall have a multiple segmented lens and provide coverage for up to a 40’ x 40’ room.

B. All sensors shall be capable of operating normally with any electronic ballasts and compact fluorescent lamp systems.
C. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

D. All sensors shall have readily accessible, user adjustable controls for time delay (0 - 15 minutes) and sensitivity.

E. In the event of failure, a bypass manual "override on" shall be provided on each sensor. When bypass is utilized, control shall divert to a wall switch until sensor is replaced.

F. All sensors shall provide a method of indication to verify that motion is being detected during testing and that the unit is working.

G. All sensors shall have no leakage current to load, in manual or in Auto/Off mode, for safety purposes and shall have voltage drop protection.

2.2 CIRCUIT CONTROL HARDWARE - CU

A. Control unit(s) shall mount through a 2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer shall provide power to a maximum of four (4) sensors and shall power to a larger number of sensors where indicated on plans.

B. Relay contacts shall have ratings of:
   1. 20A - 277 VAC Ballast.
   2. Where noted on plans, provide relays with two (2) load contacts.

C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded UL Classified, jacketed cable. Cable shall be plenum rated.

2.3 MANUFACTURERS

A. Leviton.

B. Wattstopper.

C. Hubbell.

D. Lutron

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and aim sensors in the correct location required for complete coverage. Rooms shall have ninety (90) to one hundred (100) percent coverage. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. Provide additional sensors if required to properly and completely cover the respective room.

B. Locate sensors to ensure the best possible coverage in the available space and to overcome local difficulties due to space limitations or interference of structural components. Provide training necessary to familiarize Owner’s key personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION
SECTION 26 12 16
DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Two-winding transformers.
   B. Non-linear transformers.

1.2 RELATED SECTIONS
   A. Section 03 30 00 – Cast-In-Place Concrete: Concrete for supporting foundations and pads.
   B. Section 06 05 33 – Conduit.
   C. Section 26 05 26 – Grounding and Bonding.

1.3 REFERENCES
   A. NEMA ST 1 - Specialty Transformers (Except General-Purpose Type).
   B. NEMA ST 20 - Dry-Type Transformers for General Applications.
   D. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS FOR REVIEW
   A. Section 01 33 00 – Submittals Procedures for submittals.
   B. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, and rated temperature rise.

1.5 SUBMITTALS FOR INFORMATION
   A. Section 01 33 00 – Submittals Procedures for information.
   B. Test Reports: Indicate loss data, efficiency at 25, 50, 75 and 100 percent rated load, and sound level.
   C. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 SUBMITTALS FOR CLOSEOUT
   A. Section 01 77 00 – Project Closeout: Submittals for project closeout.
   B. Record actual locations of transformers in project record documents.
1.7 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS
   A. Conform to requirements of NFPA 70.
   B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.9 DELIVERY, STORAGE, AND HANDLING
   A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
   B. Handle in accordance with manufacturer’s written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.1 TWO-WINDING TRANSFORMERS
   A. Manufacturers:
      1. General Electric.
      2. Siemens.
      3. Square D.
      5. Cooper.
   B. Description: NEMA ST 20, factory-assembled, air cooled, copper winding dry type transformers, ratings as indicated.
   C. Primary Voltage: 480 volts, 3 phase.
   D. Secondary Voltage: 208Y/120 volts, 3 phase.
   E. Insulation system and average winding temperature rise for rated kVA as follows:
      1. 1-15 kVA: Class 185 with 80 degrees C rise.
      2. 16-500 kVA: Class 220 with 80 degrees C rise.
   F. Case temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.
   G. Winding Taps:
      1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
   H. Sound Levels: NEMA ST 20.
I. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.

J. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

K. Mounting:
   1. 1-15 kVA: Suitable for wall or trapeze mounting.
   2. 16-75 kVA: Suitable for wall or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor or trapeze mounting.

L. Coil Conductors: Continuous windings with terminations brazed or welded.

M. Enclosure: NEMA ST 20, Type 1 ventilated. Provide lifting eyes or brackets.

N. Isolate core and coil from enclosure using vibration-absorbing mounts.

O. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.2 SHIELDED TRANSFORMERS

A. Manufacturers:
   1. Square D.
   2. Cutler Hammer.
   4. Siemens.
   5. Cooper.

B. Factory assembled, air cooled, copper winding, dry-type, shielded isolation transformers; ratings as scheduled; capable of operating at 100 percent load continuously at an ambient temperature of 40 degrees C.

C. Insulation system and average winding temperatures rise for rated kVA as follows:
   1. KVA Rating: 15 to 300.
   2. Insulation Class: 220.
   3. Temperature Rise degrees C: 80.

D. Provide electrostatic winding shield with separate insulated grounding connection.

E. Provide neutral bar sized for 200 percent of secondary phase conductors.

F. Manufactured and tested in accordance with IEEE C57.12.91, UL 1561, and NEMA ST 20 at K factor rating of 13.

G. Primary Voltage: 480 volts, 3 phase.

H. Secondary Voltage: 208Y/120 volts, 3 phase.

I. Winding Taps:
   1. Transformers Less than 15 kVA: Two 5 percent below rating rated voltage, full capacity taps on primary winding.
J. Sound Levels: NEMA ST 20.

K. Basic Impulse Level: 10 kV for transformers less than 300 kVA, 30 kV for transformers 300 kVA and larger.

L. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

M. Mounting:
   1. 1-15 kVA: Suitable for wall or trapeze mounting.
   2. 16-75 kVA: Suitable for wall or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor or trapeze mounting.

N. Coil Conductors: Continuous windings with terminations brazed or welded.

O. Enclosure: NEMA ST 20, Type 1 ventilated. Provide lifting eyes or brackets.

P. Isolate core and coil from enclosure using vibration-absorbing mounts.

Q. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

R. Case Temperature: Do not exceed 60 degrees C rise above ambient at warmest point at full load.

2.3 SOURCE QUALITY CONTROL

A. Production test each unit according to NEMA ST20.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformers plumb and level. Hold transformers minimum of 6 inches from walls.

B. Use flexible conduit, under the provisions of Section 26 05 33, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.

D. Mount floor-mounted transformers on concrete pads. Provide 6” high pad with 6” x 6” continuous wire mesh at vertical center of pad. Extend pad 3” beyond front and sides of transformer. Provide 1 inch x 45 degree chamfer at front and side edges.

E. Mount trapeze-mounted transformers as indicated.

F. Provide seismic restraints. Provide lateral and longitudinal bracing using 1-5/8” square steel channel.

G. Provide grounding and bonding in accordance with Section 26 12 16.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Perform inspections and tests listed in NETA ATS, Section 7.2.

3.3 ADJUSTING
A. Measure primary and secondary voltages and make appropriate tap adjustments.

3.4 CLEANING
A. Section 01 71 00 – Cleaning: Clean installed work.
B. Touch up scratched or marred surfaces to match original finishes.
C. Clean dust and debris from interior and exterior of transformer according to manufacturer’s instructions.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Distribution panelboards.
B. Branch circuit panelboards.

1.2 RELATED SECTIONS

A. Section 26 05 26 – Grounding and Bonding.
B. Section 26 05 53 – Electrical Identification.
C. Section 26 43 13 – Surge Protective Devices (SPDs).
D. Section 26 27 13 – Electrical Sensing and Measurement.

1.3 REFERENCES

A. NECA Standard of Installation (published by the National Electrical 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 Electrical Code.

1.4 SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittals Procedures for submittals.
B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
C. Arrange circuit breakers in panels same as shown on plans.

1.5 SUBMITTALS FOR INFORMATION
A. Section 01 33 00 – Submittal Procedures for information.

B. Submit manufacturer’s installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 SUBMITTALS FOR CLOSEOUT

A. Section 01 77 00 – Project Closeout: Submittals for project closeout.

B. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70-08.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.9 MAINTENANCE MATERIALS

A. Section 01 77 00 – Project Closeout.

PART 2 -PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

A. Manufacturers:

   1. General Electric.
   2. Siemens.
   3. Square D.

B. Description: NEMA PB 1, circuit breaker type.

C. Service Conditions:

   1. Temperature: 100 degrees F.
   2. Altitude: 5400 feet.

D. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

E. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Provide higher ratings where indicated.
F. Molded Case Circuit Breakers: NEMA AB 1, circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for heating, air conditioning, or refrigeration equipment branch circuits. Provide circuit breakers UL listed SWD for NO-OFF control of lighting or other loads.

G. Provide handle locks for certain breakers.

H. Enclosure: NEMA PB 1, Type 1 for dry locations, type 3R for exterior locations.

I. Cabinet Front: Surface type, fastened with hinge and latch, hinged door with flush lock, metal directory frame, finish in manufacturer's standard gray enamel. Where multiple section cabinets are specified, all cabinets shall be of same dimensions.

J. Where multiple section panel cabinets are specified, all cabinets shall be of same dimensions.

K. Provide distribution panels with factory installed transient voltage surge suppressors rated 160KA. See specification section 16685.

2.2 LIGHTING AND APPLIANCE PANELBOARDS

A. Manufacturers:
   1. General Electric.
   2. Siemens.
   3. Square D.

B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

D. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards; 14,000 amperes rms symmetrical for 480 volt panelboards. Provide higher ratings where indicated.

E. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for heating, air conditioning, or refrigeration equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.

F. Enclosure: NEMA PB 1, Type 1 for dry locations, type 4X for exterior locations.

G. Cabinet Box: 6 inches deep, 20 inches wide. Where multiple section cabinets are specified, all cabinets shall be of same dimensions.

H. Cabinet Front: With concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel. Where multiple section cabinets are specified, all cabinets shall be of same dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install panelboards in accordance with NEMA PB 1.1 and the NECA “Standard of Installation.”

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor and with handle of top circuit breaker no more than 6’-6” above floor.

D. Provide filler plates for unused spaces in panelboards.

E. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

F. Provide screw-on type engraved plastic nameplates under the provisions of Section 16195.

G. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Stub spare conduits out of wall minimum 6” below roof joist in areas with exposed roof structure. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.

H. Ground and bond panelboard enclosure according to Section 26 05 26.

I. Do not splice conductors in panelboard cabinets.

J. Land only one conductor to each circuit breaker. Where multiple conductors are used, splice in junction box before entering panelboard.

K. Where multiple ground terminal strips are provided with new panels, run solid, bare, #8AWG between all ground terminal strips.

L. Provide and install arc flash warning signs per NEC 110.16.

3.2 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.4 for switches, Section 7.5 for circuit breakers.

3.3 CLEANING

A. Section 01 71 00 – Cleaning: Clean installed work.

B. Touch up scratched or marred surfaces to match original finish.

C. Clean dust and debris from interior and exterior of panelboards.

END OF SECTION
SECTION 26 27 13
ELECTRICAL SENSING AND MEASUREMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Watthour meters.
B. Instrument transformers.

1.2 RELATED SECTIONS
A. Section 26 24 16 - Panelboards

1.3 REFERENCES
A. ANSI C12 - Code for Electricity Metering.
B. ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments.
B. ANSI C57.13 - Requirements for Instrument Transformers.
C. NFPA 70 - National Electrical Code.

1.4 SUBMITTALS
A. Submit under provisions of Section 01 33 00 –Submittal Procedures.
B. Product Data: Provide electrical ratings, adjustment ranges, enclosure type, outline dimensions, mounting dimensions, and terminal connection information.
C. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WATTHOUR METERS
A. Digital Watthour meter: Elster #A3TL.
B. Provide separate meters for main service and for pharmacy. Meter for main service shall be used in conjunction with current transformers. Meter for pharmacy shall be rated 100 amperes, 480Y/277 volts and shall be direct connected.
2.2 METERING TRANSFORMERS

A. Manufacturers:
   1. General Electric.
   2. Siemens.
   3. Square D.
   4. EMON.

B. Current Transformers: ANSI C57.13; 5 ampere secondary, bar or window type, with primary/secondary ratio as required or shown on Drawings, burden and accuracy consistent with connected metering and relay devices, 60 Hertz. Primary ampere rating shall be 60 to 80 percent of service equipment ampere rating.

C. Remote mount meters in electrical room.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Field calibrate current transformers and watthour meter to ±1% accuracy or better. Under Section 01 77 00 – Phase Turnover and Contract Closeout, submit calibration results as part of O & M manual.

END OF SECTION
SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Wall switches.
B. Receptacles.
C. Device plates and decorative box covers.
D. Floor box service fittings.

1.2 REFERENCES
A. NECA - Standard of Installation.
B. NEMA WD 1 - General Requirements for Wiring Devices.
C. NEMA WD 6 - Wiring Device -- Dimensional Requirements.
D. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW
A. Section 01 33 00 – Submittal Procedures for submittals.
B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.4 SUBMITTALS FOR INFORMATION
A. Section 01 33 00 – Procedures for information.
B. Submit manufacturer's installation instructions.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 WALL SWITCHES
A. Manufacturers:
   1. Hubbell
2. Pass & Seymour
3. Leviton
4. G.E.

B. Description: NEMA WD 1, Heavy-Duty, AC only general-use snap switch. Provide single pole, double pole, three-way, four-way, pilot light, or momentary contact type as indicated.

C. Body and Handle: Plastic with toggle handle.

D. Indicator Light: Separate pilot strap; red lens.

E. Ratings:
   1. Voltage: 120-277 volts, AC.

F. For control of mechanically held contactors or relays; provide three position, momentary contact switches with spring return to center off position. Momentary contact switches shall be rated 120/277 volt, 20 amperes.

G. Color: Architect shall select from manufacturers standard colors. Note: Architect may choose multiple colors throughout project.

2.2 RECEPTACLES

A. Manufacturers:
   1. Hubbell
   2. Pass & Seymour
   3. Leviton
   4. G.E.

B. Description: NEMA WD 1, heavy duty, specification grade receptacle. In barber shop and beauty shop waiting area, provide safety type receptacles which shall discourage insertion of foreign object into receptacle by small children.

C. Device Body: Nylon.

D. Configuration: NEMA WD 6, type as specified and indicated.

E. Convenience Receptacle: Type 5-20.

F. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements. Devices shall utilize “Lock Out” technology to ensure outlet can not be used if ground fault protection fails. Device shall have status LED.

G. Isolated Ground Receptacle: Type 5-20. Provide with orange body and plate.

H. Color: Architect shall select from manufacturers standard colors. Note: Architect may choose multiple colors throughout project.

2.3 WALL PLATES

A. Decorative Cover Plate: Smooth nylon in all areas except food prep. Devices in food prep shall be stainless steel. Manufacturer same as device manufacturer. Color to match device.
B. Exterior Wall Receptacle Cover: Receptacles shall be installed recessed 2” into wall. The receptacle cover shall have ports to allow two 3/8” diameter cords to pass through and must not protrude over ½” from wall surface. Recessed enclosure must have gasket between the enclosure and the mounting surface, and between the cover and sleeve to assure that the enclosure is “Weather proof while in use.” The enclosure shall be UL Listed. Enclosure manufactured by TayMac Corporation, Intermatic, or equal. **Failure to provide enclosure as specified will result in demolition of incorrect work and installation of work in compliance with specifications at contractors expense.**

2.4 FLOOR MOUNTED SERVICE FITTINGS

A. Manufacturers:
1. Hubbell
2. Pass & Seymour
3. Leviton
4. G.E.

B. Flush Cover Convenience Receptacle:
4. Threaded screw cover.
5. Split nozzle cable protector.

C. Flush Cover Communication Outlet:
1. Material: Brass.
2. Configuration: 2-1/8 inch dia threaded opening.
3. Threaded screw cover.
4. Split nozzle cable protector.

D. Flush Cover Combination Fitting:
1. Material: Brass.
3. Two threaded screw covers.
4. Two split nozzle cable protector.

E. Protective Ring: Brass finish.

F. Split Nozzle: Brass finish.

G. Carpet Ring: Brass.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that outlet boxes are installed at proper height.

B. Verify that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that floor boxes are adjusted properly to ensure covers will be flush with floor covering.
Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION
A. Provide extension rings to bring outlet cover plates flush with finished floor covering.
B. Clean debris from outlet boxes.

3.3 INSTALLATION
A. Install in accordance with NECA "Standard of Installation."
B. Install devices plumb and level.
C. Install switches with OFF position down.
D. Install receptacles with grounding pole on top.
E. After connecting wires to GFCI receptacles, wrap terminals with four layers of electrician's tape.
F. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
G. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
H. Connect wiring devices by wrapping conductor around screw terminal when using solid conductors. Provide crimp on lugs for terminations when using stranded conductors.
I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas and above accessible ceilings.
J. Install split nozzle on active flush cover service fittings. Turn spares over to Contracting Officer. Obtain hand receipt showing number transferred and include with O and M manual.
K. Install split nozzle on active flush cover service fittings.

3.4 INTERFACE WITH OTHER PRODUCTS
A. Coordinate locations of outlet boxes provided under Section 26 05 34 to obtain mounting heights indicated on drawings.
B. Coordinate the installation of wiring devices with underfloor duct service fittings provided under Section 26 05 43.

3.5 FIELD QUALITY CONTROL
A. Inspect each wiring device for defects.
B. Operate each wall switch with circuit energized and verify proper operation.
C. Verify that each receptacle device is energized.
D. Test each receptacle device for proper polarity.
E. Test each GFCI receptacle device for proper operation.
3.6 CLEANING

A. Clean installed work.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Fuses.

1.2 REFERENCES
B. NEMA FU 1 - Low Voltage Cartridge Fuses.

1.3 SUBMITTALS
A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
B. Product Data: Provide data sheets showing electrical characteristics including time-current curves.

1.4 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01 78 39 – Project Record Documents.
B. Record actual fuse sizes.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Class L: Bussman Hi-Cap or approved equal.
B. Class RK1: Bussman Low-Peak or approved equal.

2.2 FUSE REQUIREMENTS
A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.
B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.
C. Switches Larger than 600 amperes: UL Class L (time delay).
D. Switches 600 amperes or Smaller: UL Class RK1 (time delay).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION
SECTION 26 28 16
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SECTION INCLUDES
   A. Enclosed circuit breakers.

1.2 REFERENCES
   A. NECA (National Electrical Contractors Association) “Standard of Installation.”
   B. NEMA AB 1 - Molded Case Circuit Breakers
   B. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS
   A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
   B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.
   C. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 QUALITY ASSURANCE
   A. Perform Work in accordance with NECA Standard of Installation.
   B. Provide U.L. service equipment listing and labeling.

1.5 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
   A. Conform to requirements of NFPA 70.
   B. Furnish products listed and classified by UL as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. General Electric.
   B. Siemens.
2.2 MOLDED CASE CIRCUIT BREAKER
A. Circuit Breaker: NEMA AB 1.
B. Service Conditions:
   1. Temperature: 104 or less degrees F.
   2. Altitude: 5400 feet.

2.3 TRIP UNITS
A. A field adjustable trip circuit breaker. Provide circuit breakers with frame sizes 200 amperes and larger with mechanism for adjusting long time and short time continuous current, short time and long time pickup current settings for automatic operation.

2.4 PRODUCT OPTIONS AND FEATURES
A. Provide accessories as shown on plans.
B. Provide grounding lug in each enclosure.
C. Handle Lock: Include provisions for pad locking.
D. Provide products suitable for use as service entrance equipment.

2.5 ENCLOSURE
A. Enclosure: NEMA AB 1, Type 1 3R or 4X as required by conditions.
B. Fabricate enclosure from steel.
C. Finish using manufacturer's standard enamel finish gray color.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.
B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 26 05 29.
C. Height: 5 ft to operating handle for breakers not in panelboards.
D. Provide engraved plastic nameplates under the provisions of Section 26 05 53.

3.2 FIELD QUALITY CONTROL
A. Inspect and test each circuit breaker to NEMA AB 1.
B. Inspect each circuit breaker visually.
C. Perform several mechanical ON-OFF operations on each circuit breaker.
D. Verify circuit continuity on each pole in closed position.

E. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.

F. Include description of testing and results in test report.

3.3 ADJUSTING

A. Adjust work under provisions of Section 01 71 00 – Project Closeout.

B. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

C. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

3.4 CLEANING

A. Section 01 71 00 – Cleaning: Clean installed work.

B. Touch up scratched or marred surfaces to match original finish.

C. Clean dust and debris from interior and exterior of enclosed circuit breakers.

END OF SECTION
SECTION 26 28 17
ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Fusible switches.
B. Nonfusible switches.

1.2 REFERENCES
A. NECA - Standard of Installation (published by the National Electrical Contractors Association).
B. NEMA FU1 - Low Voltage Cartridge Fuses.
C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW
A. Section 01 33 00 – Submittal Procedures for submittals.
B. Product Data: Provide switch ratings and enclosure dimensions.

1.4 SUBMITTALS FOR CLOSEOUT
A. Section 01 77 00 – Project Closeout: Submittals for project closeout.
B. Record actual locations of enclosed switches in project record documents.

1.5 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. General Electric.
2.2 FUSIBLE SWITCH ASSEMBLIES
A. Description: NEMA KS 1, Type HD, enclosed load interrupter knife switch. Handle lockable in OFF position.
B. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses. Provide rejection clips to prevent the use of other than Class R fuses.

2.3 NONFUSIBLE SWITCH ASSEMBLIES
A. Description: NEMA KS 1, Type HD enclosed load interrupter knife switch. Handle lockable in OFF position.

2.4 ENCLOSURES
A. Fabrication: NEMA KS 1.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

PART 3 - EXECUTION
3.1 INSTALLATION
A. Install in accordance with NECA “Standard of Installation.”
B. Install fuses in fusible disconnect switches with fuse labels visible from fronts of enclosures.
C. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.
D. Provide engraved nameplates for switches not in sight of controlled loads. Indicate load type and location and correct fuse size for fusible switches.

3.2 FIELD QUALITY CONTROL
A. Inspect and test in accordance with NETA ATS, except Section 4.
B. Perform inspections and tests listed in NETA ATS, Section 7.5.

3.3 CLEANING
A. Section 01 71 00 - Cleaning: Clean installed work.
B. Touch up scratched or marred surfaces to match original finishes.
C. Clean dust and debris from interior and exterior of cabinet.

END OF SECTION
SECTION 26 29 13
ENCLOSED MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual motor starters.
B. Magnetic motor starters.
C. Combination magnetic motor starters.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code.
B. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Type.
C. UL 198E - Class R Fuses.
E. NEMA AB 1 - Molded Case Circuit Breakers.
F. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
G. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
H. NEMA KS 1 - Enclosed Switches.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittal Procedures.
B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
C. Test Reports: Indicate field test and inspection procedures and test results.
D. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.6 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Square D.
B. Siemens.
C. G.E.
D. Cutler Hammer.

2.2 MANUAL CONTROLLERS
A. Manual Motor Controller: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller without overload element, red pilot light, when not in sight of controlled motor and toggle operator. Flush mount in finished spaces such as toilets and janitor closets.
B. Enclosure: NEMA ICS 6; Type 1 unless otherwise noted.

2.3 AUTOMATIC CONTROLLERS
A. Magnetic Motor Controllers: NEMA ICS 2, AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
B. Coil operating voltage: 120 volts, 60 Hertz.
C. Overload Relay: NEMA ICS; melting alloy.
D. Enclosure: NEMA ICS 6, Type 1 for interior, dry locations, Type 3R for exterior locations.

2.4 PRODUCT OPTIONS AND FEATURES
A. Auxiliary Contacts: NEMA ICS 2, 2 each normally open and normally closed.
B. Cover Mounted Pilot Devices: NEMA ICS 2, heavy duty type, HAND-OFF-AUTO rotary switch unless noted otherwise.
C. Pilot Device Contacts: NEMA ICS 2, Form Z, rated A150.
D. Pushbuttons Where Required: Unguarded STOP, shrouded START unless noted otherwise.
E. Indicating Lights: LED type red RUN light unless otherwise noted.
F. Relays: NEMA ICS 2.

2.5 DISCONNECTS

A. Combination Controllers: Combine motor controllers with non-fusible switch disconnect in common enclosure.

B. Non-fusible Switch Assemblies: NEMA RS-1 enclosed knife switch with externally operable handle.

PART 3 -EXECUTION

3.1 INSTALLATION

A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed controllers plumb. Provide supports in accordance with Section 26 05 29.

C. Height: 5 ft to operating handle, switch, or pushbutton.

D. Provide screw-on type engraved plastic nameplates under the provisions of Section 16195. Nameplates shall indicate load type and location.

E. Provide neatly typed label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.2 FIELD QUALITY CONTROL

A. Inspect and test each enclosed controller to NEMA ICS 2.

3.3 CLEANING

A. Section 01 71 00 – Cleaning: Cleaning installed work.

B. Touch up scratched or marred surfaces to match original finish.

C. Clean dust and debris from interior and exterior of motor controller.

END OF SECTION
SECTION 26 29 24
ENCLOSED CONTACTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. General purpose contactors.
B. Lighting contactors.

1.2 REFERENCES
A. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
C. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS FOR REVIEW
A. Section 01 33 00 – Submittal Procedures for submittals.
B. Product Data: Provide dimensions, size, voltage ratings and current ratings.

1.4 SUBMITTALS FOR INFORMATION
A. Section 01 33 00 – Submittal Procedures for information.
B. Submit manufacturer's installation instructions.

1.5 PROJECT CLOSEOUT SUBMITTALS
A. Section 01 77 00 – Project Closeout.
B. Record actual locations of each contactor and indicate circuits controlled on project record documents.
C. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.6 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS
A. Conform to requirements of NFPA 70.
B. Provide Products listed and classified by Underwriters Laboratories, Inc., as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 GENERAL PURPOSE CONTACTORS
A. Manufacturers:
   1. General Electric.
   2. Siemens.
   3. Square D.
   4. Asco.
   5. Allen-Bradley.
   6. Cutler Hammer.

B. Description: NEMA ICS 2, AC general purpose mechanically held magnetic contactor.

C. Coil Voltage: 120 volts, 60 Hertz or as indicated. Separate latching and unlatching coils with coil clearing contacts in series with each coil to ensure only momentary contact.

D. Poles: As scheduled or indicated.

E. Size: As scheduled or indicated.

F. Enclosure: ANSI/NEMA ICS 6, Type as required to meet conditions of installation.

G. Surface mount in janitor, mechanical and electrical spaces. Surface mount above panels where panel is surface mounted. Flush mount above flush mounted panel or surface mount above accessible ceiling.

H. Label per Section 26 05 53.

2.2 LIGHTING CONTACTORS

A. Manufacturers:
   1. General Electric.
   2. Siemens.
   3. Square D.
   4. Asco.
   5. Allen-Bradley.
   6. Cutler Hammer.

B. Description: NEMA ICS 2, magnetic lighting contactor.

C. Configuration: Mechanically held, 3 wire control.

D. Coils: 120 volts, 60 Hertz. Separate latching and unlatching coils with clearing contacts in series with each coil to ensure only momentary energization of coils.

E. Poles: As scheduled or indicated.

F. Contact Rating: As scheduled or indicated. Match branch circuit overcurrent protection, considering derating for continuous loads.

G. Enclosure: ANSI/NEMA ICS 6, Type as required to meet conditions of installation.

H. Accessories:
   1. Auxiliary Contacts: Two field convertible.

I. Label per Section 26 05 53.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount contactors true and plumb according to manufacturer’s written instructions.
B. Ensure proper operation by several open/close operations of the load contacts.

3.2 CLEANING

A. Section 01 71 00 – Cleaning: Cleaning installed work.
B. Touch up scratched or marred surfaces to match original finish.
C. Clean dust and debris from interior and exterior of contactors.

3.3 LABELLING

A. Provide engraved nameplate per 26 05 53. Nameplate shall indicate contactor designation and branch circuits controlled. Example: “CONTACTOR CH5A” on first line; “CKTS H5-1, 2, 5, 6, 9,10,13,14 ……. on second line. See contactor schedule.

END OF SECTION
SECTION 26 43 13

SURGE PROTECTIVE DEVICES (SPDs)

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Contractor provide:
   1. SPD units mounted integral to switchboard.
   2. SPD units mounted integral to panelboards as indicated on riser diagram.

1.2 RELATED SECTIONS

A. Section 26 24 16 – Panelboards.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Underwriters Laboratory (UL)
B. American National Standards Institute (ANSI)
C. Institute of Electrical and Electronics Engineers (IEEE)
D. National Electrical Manufacturers Association (NEMA)
E. National Fire Protection Association (NFPA)
F. Occupational Safety and Health Act (OSHA)
G. Federal Information Processing Standards, Pub 94 (FIPS)
H. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits, Category C
J. UL 1449, Current Edition – Surge Protective Devices
K. UL 1283
L. NEMA LS-1, Low Voltage Surge Protective Devices
M. NEC Article 285

1.4 SUBMITTALS

A. In accordance with Section 01 33 00, provide:
   1. Shop drawings and product data sheets indication physical and electrical characteristics in accordance with Division 1.
   2. UL1449 file card copies.
   3. Third party test results verifying label ratings.

1.5 WARRANTY
A. Warrant all equipment for ten (10) years from date of shipment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Liebert.
B. Current Technology.
C. EFI Electronics.
D. United Power.
E. Leviton.
F. Square D.
G. Seimens ITE.
H. G.E.

2.2 ELECTRICAL REQUIREMENTS

A. SPD Types

1. Service Entrance: SPD shall be UL 1449 labeled as Type 1 or Type 4 intended for Type 1 or Type 2 applications, verifiable at UL.com, without need for external or supplemental overcurrent controls.
2. Distribution Panel and Motor Control Center: SPD shall be UL 1449 labeled as Type 4 intended for Type 1 or Type 2 applications, verifiable at UL.com, without need for external or supplemental overcurrent controls.
3. Branch Panels: The panelboard shall be UL 67 listed and the SPD shall be UL 1449 labeled as Type 1 or as Type 4 intended for Type 1 or Type 2 applications

B. Nominal System Operating Voltages

1. 480Y/277 VAC, 3-phase, 4 wire, plus ground for switchboard.
2. 208Y/120 VAC, 3-phase, 4 wire, plus ground for panelboard units.

C. Maximum Continuous Operating Voltages (MCOV)

1. 125% of nominal system operating voltage.

D. Operating Frequency

1. 60 Hertz.

E. Seven (7) Protection Modes on Grounded Wye System

1. L-G, L-N and N-G (L = Line, N = Neutral, and G = Ground).

F. The SPD shall be UL Tested and labeled as a complete assembly to a symmetrical fault current rating greater than or equal to the rating of the connected panel, in accordance with NEC Article 285, without the requirement of a dedicated breaker feeder to obtain the fault current withstand rating.

G. The Voltage Protection Rating (VPR) shall be tested with the integral disconnect in accordance with UL-1449, Third Edition. The UL VPR values shall not exceed the following
(including disconnect). If the device is remote mounted it shall be fed by a circuit breaker and the UL VPR rating shall include the breaker in series with the SPD.

H. Maximum UL 1449 Voltage Surge (Category C1)

<table>
<thead>
<tr>
<th>System Voltage</th>
<th>L-N, L-G, N-G Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120 VAC</td>
<td>800V</td>
</tr>
<tr>
<td>480Y/277 VAC</td>
<td>1200V</td>
</tr>
</tbody>
</table>

I. Protection and Filtering Elements:

1. The SPD shall have a maximum surge current rating of:
   - Service Entrance: 300 kA per mode
   - Distribution Panel: 160 kA per mode
   - Branch Panel: 160 kA per mode

   Devices that derive a maximum surge current rating by adding test results of individual components are not acceptable. Test documentation of kA rating shall be required. Devices must be rated per mode, not per PHASE per NEMA.

2. The SPD device repetitive surge current capacity shall be tested utilizing a 1.2x50ms, 20kV open circuit voltage, 8x20ms, 10kA short circuit Category C3 test waveform (as defined by ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1992) at one minute intervals. A failure is defined as either performance degradation or more than 10% deviation of clamping voltage at the specified surge current. The service entrance device shall be capable of surviving a minimum of 20,000 C3 impulses without failure or performance degradation of more than 10%. Downstream devices shall be capable of surviving a minimum of 5,000 C3 impulses without failure or performance degradation of more than 10%.

3. The SPD device shall be capable of surviving a minimum of 5,000 surges using a 10x1000ms impulse (1kV, 4kA for 277/480V devices, .5kV, 2kA for 120/208V devices), confirmed by an independent nationally recognized test lab (R&B Labs).

4. Systems using selenium, gas tubes or silicon avalanche diodes in surge current path are not acceptable.

5. The Maximum Continuous Operating Voltage (MCOV) for all voltage configurations shall be 125% of nominal or greater.

6. The fusing system shall be capable of allowing the rated maximum surge current to pass through without fuse operation. Systems utilizing a fusing system that opens below the maximum surge current level are unacceptable. The fusing system shall be included in the surge current testing.

J. The SPD shall incorporate a UL 1283 listed EMI/RFI filter with minimum attenuation of –50dB at 100kHz.

K. The SPD shall be UL labeled with 20kA I-nominal (I-n).

L. Overcurrent Protection:

1. Fuses rated for 200 KAIC (integral fused disconnect).

M. Diagnostic Monitoring:

1. Fuse monitoring.
2. MOV monitoring.
4. Form C contacts for remote annunciation of unit status.
5. Press-to-test diagnostics to verify operational integrity of monitoring system.
6. Surge event counter and audible alarm.
7. Remote status monitor.
N. Serviceability:

1. SPD system module(s) must be field replaceable by qualified individuals or licensed Electricians.

O. Equipment Mounting:

1. Switchboard & Distribution Panel SPD – The SPD shall include an integral disconnect switch which has been tested to the surge current rating of the SPD and match or exceed the fault current rating of the board per NEC 285. The Disconnect must switch the phases and neutral. Use of circuit breakers for disconnect means is not acceptable due to impedance and the requirement for neutral disconnect. The SPD shall be mounted integral to the equipment.

2. Branch panel SPD – the SPD shall be direct bus to bus connected. Use of a breaker to feed an integral device shall not be acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install SPD units per manufacturer's written recommendations.

B. Verify SPD unit ratings with service rating and voltage characteristics, and with Electrical Requirements section of this specification. Ensure proper system configuration and coordination prior to ordering any equipment.

C. Do not drill or tap equipment bus bars. Use suitable bolted bus connectors.

D. Connect separately mounted SPD units to equipment with input conductors that are as short and straight as practically possible. Twist input conductors to reduce inductance.

E. Provide source breaker or fused disconnect switch for SPD units sized in accordance with SPD manufacturer's recommendations.

F. Ground equipment and SPD units per manufacturer's recommendations, NEC, and Section 26 05 26.

G. Provide mounting brackets, bus bar, breaker stabs, and filler pieces for unused spaces.

3.2 FIELD QUALITY CONTROL

A. Perform SPD unit tests according to manufacturer's instructions. Provide verification of test results to Architect/Engineer.

B. Provide services of manufacturer's factory trained Engineer for length of time required to:

   1. Coordinate installation.
   2. Conduct functional tests on all equipment and field test listed herein.
   3. Provide training during normal working hours to AAFES’s personnel in operation, testing, adjusting, and maintenance.
   4. Submit written report to Architect/Engineer and AAFES stating results of tests conducted and listing personnel trained.

3.3 ADJUSTMENT AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Tighten bus connections and mechanical fasteners, in accordance with manufacturer's published torque value recommendations and UL 486A and B.
C. Touch-up scratched or marred surfaces to match original finish.

D. Clean interior and exterior of enclosure.

END OF SECTION
SECTION 26 51 00
INTERIOR LUMINAIRES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Interior luminaires and accessories.
B. Exit signs.
C. Ballasts.
D. Lamps.
E. Luminaire accessories.

1.2 REFERENCES
A. NEMA WD 6 - Wiring Devices-Dimensional Requirements.
B. NFPA 70 - National Electrical Code.
D. UFC 3-530-1 - Unified Facility Criteria (April 2015).

1.3 SUBMITTALS FOR REVIEW
A. Section 01 33 00 – Submittal Procedures for submittals.
B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
C. Product Data: Provide dimensions, ratings, and performance data.
D. Photometric Analysis: Provide photometric calculations performed per AAFES criteria for any fixture substitutions.

1.4 SUBMITTALS FOR INFORMATION
A. Section 01 33 00 – Submittal Procedures for information.
B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 SUBMITTALS FOR CLOSEOUT
A. Section 01 77 00 – Project Closeout: Submittals for project closeout.
B. Submit manufacturer's operation and maintenance instructions for each product.
C. Warranty for normal ballasts, exit signs, and emergency standby ballasts.
1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Conform to requirements of NFPA 101.
C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.1 LUMINAires

A. Provide products as scheduled. Contractors wishing to submit voluntary substitutions shall submit complete cut sheet information showing fixture dimensions, options and photometrics performed per AAFES standards. Alternate fixtures must be received at engineers’ office minimum two weeks prior to bidding. Engineers’ evaluation shall be final. Fixtures submitted without prior approval will be returned to contractor without comment.

1. APPROVED MANUFACTURERS

a. General Electric
b. Lithonia/Acuity Brands
c. Columbia (Hubble and Prescolite)
d. LSI Industries
e. Leviton
f. Finelite

B. Luminaires shall be provided such that the illumination levels in the following table are met within +10%. Calculations are to include a 0.90 (LLF) Light Loss Factor at 40° A.F.F. working plane along with the following criteria from the table below:

<table>
<thead>
<tr>
<th>AREA</th>
<th>ILLUMINATION LEVELS (FC)</th>
<th>UNIFORMITY - NOT TO EXCEED (AVG : MIN)</th>
<th>REFLECTANCES (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HORIZONTAL / VERTICAL</td>
<td>CEILING/WALL/FLOOR</td>
<td></td>
</tr>
<tr>
<td>Sales floor – Drop ceiling</td>
<td>65/30</td>
<td>2.0 : 1</td>
<td>80 / 50 / 20</td>
</tr>
<tr>
<td>Sales floor – Open ceiling</td>
<td>65/30</td>
<td>2.0 : 1</td>
<td>50 / 50 / 20</td>
</tr>
<tr>
<td>Dressing room</td>
<td>40/NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>Bathroom &amp; Locker room</td>
<td>20/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>MPA – processing</td>
<td>30/NR</td>
<td>4.0 : 1</td>
<td>50 / 40 / 20</td>
</tr>
<tr>
<td>MPA – non-processing</td>
<td>NR/20</td>
<td>4.0 : 1</td>
<td>50 / 40 / 20</td>
</tr>
<tr>
<td>Food Court</td>
<td>20/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>Mall with Kiosk(s)</td>
<td>40/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>Mall without Kiosk</td>
<td>30/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>Food preparation</td>
<td>50/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>Offices</td>
<td>40/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
<tr>
<td>Employee lounge / Break</td>
<td>30/ NR</td>
<td>4.0 : 1</td>
<td>80 / 50 / 30</td>
</tr>
</tbody>
</table>
2.2 LED LUMINAIRIES

A. Provide luminaires complete with power supplies (drivers) and light sources. Provide design information including lumen output and design life in luminaire schedule on project plans for LED luminaires. LED luminaires must meet the minimum requirements in the following table:

<table>
<thead>
<tr>
<th>LUMINAIRE TYPE</th>
<th>MINIMUM LUMINAIRE EFFICACY (LE)</th>
<th>MINIMUM COLOR RENDERING INDEX (CRI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED Troffer</td>
<td>90 LPW</td>
<td>80</td>
</tr>
<tr>
<td>LED Downlight</td>
<td>50 LPW</td>
<td>80</td>
</tr>
<tr>
<td>LED Track or Accent</td>
<td>40 LPW</td>
<td>80</td>
</tr>
<tr>
<td>LED Low Bay/High Bay</td>
<td>80 LPW</td>
<td>80</td>
</tr>
<tr>
<td>LED Linear Ambient</td>
<td>80 LPW</td>
<td>80</td>
</tr>
</tbody>
</table>

B. LED luminaires must also meet the following minimum requirements:

1. Luminaires must have a minimum 10 year manufacturer's warranty. LED warranties must be 10-years per Unified Facility Criteria (UFC) 3-530-1 dated April 2015.

2. Luminaires must have a minimum L90 lumen maintenance value of 50,000 hours as calculated by IES TM-21, with data obtained per IES LM-80 requirements.

3. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

4. Luminaires must be tested to IES LM-79 and IES LM-80 standards, with the results provided as required in the Submittals paragraph of this specification.

5. Luminaires must be listed with the DesignLights Consortium 'Qualified Products List' when falling into category of "General Application" luminaires, i.e. Interior Directional, Display Case, Troffer, Linear Ambient, or Low/High Bay. Requirements are shown in the Designlights Consortium "Technical Requirements Table" at https://data.energystar.gov/dataset/EPA-Recognized-Laboratories-For-Lighting-Products

6. Provide Department of Energy 'Lighting Facts' label for each luminaire.

7. All LED luminaires shall have a correlated color temperature (CCT) of 3500K

2.3 LED Drivers

A. NEMA SSL 1, UL 8750. LED drivers must be electronic, UL Class 1, constant-current type and comply with the following requirements:
B. Output power (watts) and luminous flux (lumens) as shown in luminaire schedule for each luminaire type to meet minimum luminaire efficacy (LE) value provided.

C. Power Factor (PF) greater than or equal to 0.9 over the full dimming range when provided.

D. Current draw Total Harmonic Distortion (THD) of less than 20 percent.

E. Class A sound rating.

F. Operable at input voltage of 120-277 volts at 60 hertz.

G. Minimum 10 year manufacturer's warranty.

H. RoHS compliant.

I. Integral thermal protection that reduces or eliminates the output power if case temperature exceeds a value detrimental to the driver.

J. UL listed for dry or damp locations typical of interior installations.

H. Fully-dimmable using 0-10V control as indicated in luminaire schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. **Support recessed luminaires independent of ceiling framing.** For recessed 2X4 LED luminaires, provide four hanger wires fastened at corners of luminaires and at structural joists. Provide two hanger wires for recessed downlights and 2x2 Recessed LED luminaires. Support wires shall be same type and gauge as ceiling support wires.

B. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

C. Support surface mounted luminaires on grid ceiling directly from building structure.

D. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

E. Install recessed luminaires to permit removal from below.

F. Install accessories furnished with each luminaire.

G. Connect luminaires to branch circuit outlets provided under Section 26 05 24 using flexible conduit. In exposed grid ceiling areas, use premanufactured wiring systems at contractor’s option.

H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install specified lamps in each luminaire.

3.2 FIELD QUALITY CONTROL
A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Aim and adjust luminaries as directed.
B. Position exit sign directional arrows as indicated.

3.4 CLEANING

A. Section 01 71 0 – Cleaning installed work.
B. Clean electrical parts to remove conductive and deleterious materials.
C. Remove dirt and debris from enclosures.
D. Clean photometric control surfaces as recommended by manufacturer.
E. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

A. Prior to final acceptance, relamp/replace luminaires that have failed lamps.

END OF SECTION
SECTION 26 60 00

TESTING

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Provide:

1. Testing of electrical components and systems:
   a. Insulation resistance test.
   b. Grounding electrode test.
   c. Continuity test.
   d. Voltage test.
   e. Phase relationship verification.
   f. Fire alarm acceptance test.
   g. Power transmission equipment test.

2. Test reports.
3. Correction of defective components or systems.
4. Retest of corrected components, systems.

1.2 SUBMITTALS

A. Test Reports: Submit seven (7) copies of all test reports to Contracting Officer.

1. Type each test report on 8-1/2 inch x 11 inch paper. Include:
   a. Project Number.
   b. Project title and location.
   c. Test performed.
   d. Date performed.
   e. Test equipment used.
   f. Contractor's name, address and telephone number.
   g. Testing firm's name, address and telephone number if other than Contractor.
   h. Name (s) and title (s) of person (s):
      1. Performing test.
      2. Observing test.
   i. Statement verifying each test.
   j. Nameplate data from each motor and equipment item tested.
   k. Test results.
   l. Retest results after correction of defective components, systems.

2. For each copy, assemble all test reports and bind them in a folder. Label each folder, "Electrical Test Reports".

PART 2 - PRODUCTS

2.1 MATERIALS: Furnish all equipment, manpower and casual labor to perform specified testing.

PART 3 - EXECUTION

3.1 PREPARATION
A. When temporary electrical service is used for testing, do not energize any equipment or portion of permanent system that exceeds capacity of temporary service.

B. Ensure that all electrical work is complete and ready for testing.

C. Disconnect all devices or equipment that might be damaged by application of test voltages, voltage of reversed phase sequence or other test procedures.

3.2 TESTING: Conduct tests and adjust equipment to verify compliance with specified performance.

3.3 INSULATION RESISTANCE TESTS

A. Resistance measured; line-to-ground.

B. Perform testing on the following items:

<table>
<thead>
<tr>
<th>Item Tested</th>
<th>Voltage of Test</th>
<th>Min. Acceptance Resistance in Megohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 2 and larger cables (600V)</td>
<td>1000V</td>
<td>50</td>
</tr>
<tr>
<td>Motors</td>
<td>500V</td>
<td>5</td>
</tr>
<tr>
<td>Switchboard and Panelboard Buses</td>
<td>1000V</td>
<td>25</td>
</tr>
</tbody>
</table>

3.4 GROUNDING ELECTRODE TEST: Measure and record ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Maximum acceptable resistance: 10 ohms. When resistance exceeds 10 ohms drive and bond another ground rod, one ground rod length away and repeat test.

3.5 CONTINUITY TESTS: Test branch circuits and control circuits to determine continuity of wiring and connections.

3.6 VOLTAGE TESTS

A. Make and record voltage tests and recorded at the following listed points. Conduct tests under normal load conditions.

1. Service entrance at main panel.
2. Terminals of all motors.

3.7 PHASE RELATIONSHIP

A. Examine connections to equipment for proper phase relationships. Verify proper motor rotation.

3.8 FIRE ALARM ACCEPTANCE TEST

A. Have the fire alarm acceptance test performed by the Alarm Company Representative and Installing Contractor in the presence of the Fire Chief's Representative.

B. Acceptance Test Procedures:

<table>
<thead>
<tr>
<th>EXPECTED INDICATION ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>PANEL/RECEIVING STATION</td>
</tr>
<tr>
<td>1. Normal Power to Panel</td>
</tr>
<tr>
<td>2. Disconnect Power to Panel</td>
</tr>
<tr>
<td>3. Activate Detection Device</td>
</tr>
<tr>
<td>4. Silence Alarm Signaling Devices</td>
</tr>
<tr>
<td>5. Return Normal Power to Panel &amp; Reset Panel</td>
</tr>
<tr>
<td>6. Place Each Function Switch in an Abnormal Position</td>
</tr>
<tr>
<td>7. Remove supervised Devices from System (During this portion of testing, ensure proper wire has been used and devices are properly installed.)</td>
</tr>
</tbody>
</table>
8. Return Supervised Device to System (Normal)
9. Disconnect Normal Power to Panel (Trouble)
10. Activate Detector(s) for each Zone (Alarm)
11. Inspect all Horns Zone Indication, and Auxiliary Devices (Working List)
12. Silence Horns (Alarm/Trouble)
13. Reset System (Trouble)
14. Return Normal Power to System (Normal)
15. Place Panel in Alarm Condition. Disconnect Primary Power Source for a Minimum of 15 Seconds and Return to Normal Power. (The above transfer procedure shall not cause a loss of an alarm condition at Receiving Station.)

3.9 CORRECTION OF DEFECTS

A. When tests disclose any unsatisfactory workmanship or equipment supplied under this Contract, correct defects and retest. Repeat tests until satisfactory results are obtained.

B. When any wiring or equipment is damaged by tests, repair or replace such wiring or equipment. Test repaired items to ensure satisfactory operation.

END OF SECTION
SECTION 27 10 00

TELEPHONE SERVICE, RACEWAYS AND WIRING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Telephone service raceways and cables.
B. Equipment and terminal backboards, building entrance terminals, and gas tube protectors.
C. Premises wiring and outlets.

1.2 REFERENCES

A. EIA/TIA 568B - Commercial Building Wiring Standard.
B. EIA/TIA 569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
C. 56th Communications Squadron Standards.

TIA/ EIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
TIA/ EIA-526-14-A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant
TIA/ EIA-568-B.1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
TIA/ EIA-568-B.1-2 Commercial Building Telecommunications Cabling Standard Addendum 2- Grounding and Bonding Specifications for Screened Balanced Twisted-Pair Horizontal Cable
TIA/ EIA-568-B.3 Optical Fiber Cabling Components Standard
TIA/ EIA-568-B.3-1 Optical Fiber Cabling Components Standard Addendum 1- Additional Transmission Performance Specifications for 50/125um Optical Fiber Cables
TIA/EIA-569-B-2004 Commercial Building Standard for Telecommunications Pathways and Spaces
TIA/ EIA-569-B-1 Commercial Building Standard for Telecommunications Pathways and Spaces Addendum 1- Surface Raceways
1.3 SYSTEM DESCRIPTION

D. Premises Wiring: AAFES furnished/AAFES installed.

E. Accessories: Connector blocks, building entrance terminals, gas tube protectors, jacks, etc.

F. Grounding.

G. The telephone system equipment is AAFES furnished and installed by Exponent Systems.

1.4 SUBMITTALS

A. Submit under provisions of 01 33 00 – Submittal Procedures.

B. Product data for cables, outlets, and accessories.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 77 00 – Project Closeout.

B. Record actual locations and sizes of raceways, outlets, and cable numbering system.

1.6 QUALITY ASSURANCE
A. Perform Work in accordance with EIT/TIA, communications squadron and commercial telephone utility’s rules and regulations.

1.7 QUALIFICATIONS

A. Installer: Workers specializing in installing telephone premises wiring with minimum three years documented experience.
B. Contractors responsible for supervising or installing telecom cabling will have a minimum “Technician” BISCI certification and be factory certified from each equipment manufacturer to install and test provided products.
C. Submit names and qualifications of installers and five similar projects for each installer.
D. The equipment and hardware provided and installed shall conform to existing Luke AFB communications standards and be from manufacturers with minimum 3 years experience in producing systems specified.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.
B. Furnish Products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

1.9 SUBMITTALS FOR REVIEW

A. Section 01 33 00 – Submittal Procedures for submittals.
B. Test Plan: Test plan defining the tests required to ensure that the system meets technical, operational and performance specifications, 30 days prior to the proposed test date. The test plan must be approved before the start of any testing. The test plan shall identify the capabilities and functions to be tested, and include detailed instructions for the setup and execution of each test and procedures for evaluation and documentation of the results.
C. Test: Manufacturer’s certified on-reel test results.
D. Samples: Provide 12” sample of each cable type. Choose samples to show all information printed on jacket.
E. Test Results: Test reports in booklet form with witness signatures verifying execution of tests. Test results will also be provided in electronic format. Reports shall show the field tests performed to verify compliance with the specified performance criteria. Test reports shall include record of the physical parameters verified during testing. Test reports shall be submitted within 14 days after completion of testing.
F. Cables:
   1. A record of all installed cable shall be provided in hard copy format per EIA ANSI/TIA/EIA-606. The cable records shall include type, size, length, and final termination locations.
   2. The contractor shall provide GIS data for and infrastructure installed.
   3. A record of all installed communications equipment and outlets shall be provided in hard copy format per EIA ANSI/TIA/EIA-606. The hardware records shall include only the required data fields per EIA ANSI/TIA/EIA-606.

PART 2 - PRODUCTS
2.1 TELEPHONE TERMINATION BACKBOARDS
   A. Material: Plywood.
   B. Size: As indicated, 3/4 inch thick. Coordinate with Base fire department when area of any back board exceeds 32 sq. ft.
   C. The telephone back board shall be painted with two coats of fire retardant paint to match the surrounding walls such that the manufactures fire rated stamp remains visible.
   D. Backboards shall be fire-retardant treated wood, bearing the manufacturer’s stamp. Cover a minimum of two adjacent walls with backboards.

2.2 TELEPHONE CABLES
   A. Premise cabling shall be AAFES furnished / AAFES installed.

2.3 JACKS – AAFES furnished / AAFES installed.

2.4 PATCH PANELS – AAFES furnished / AAFES installed.

2.5 ACCESSORIES
   A. Provide the following components for terminations of cables:
      1. Wiring Blocks: 110AW1 series with legs.
      3. Designation strips indicating correct cable and pair count on wiring blocks.

2.6 GROUNDING
   A. Provide a single point ground for all communications electronic equipment. Ground shall be by a copper ground plate 6” width x length of terminal board. Install ground plate along bottom edge of terminal board. Connect ground riser with #1 AWG directly connected to ground plate with no taps. Resistance shall be 10 ohms or less measured from main ground point.

PART 3 - EXECUTION

3.1 INSTALLATION
   A. Stub minimum ¾” conduit (or larger where indicated) from each outlet location up to just below roof level. Provide bushing at end of conduit.
   B. Provide wire and cable in accordance with manufacturer’s instructions and in accordance with EIA/TIA 568.
   C. Finish paint termination backboards with durable white enamel under the provisions of Section 09 90 12 prior to installation of telephone equipment.
   D. Support raceways, backboards, and cabinets under the provisions of Section 26 05 29.
   E. Install termination backboards plumb, and attach securely to building wall at each corner.
F. The contractor shall perform the following cable tests on service cable:

1. Conductor OHM’s resistance.
2. Cable shield continuity.
3. Conductor continuity including testing all pairs for; opens, shorts, grounds, crosses, splits, reversed and transposed pairs.
4. Insulation resistance test between all groups including grounds and/or shields, and a minimum of 20% of the total conductors in each group.
5. All voice circuits shall be toned out, tested for opens, shorts, grounds, and crossed pairs.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This performance specification provides the minimum requirements for the Mass Notification / Life Safety System. The system shall include, but not limited to all design equipment, materials, labor, installation, documentation, testing and services necessary to furnish and install a complete, operational system to include but not limited to the following functions:

1. One-way voice communication notification system
2. ADA compliant visual notification system
3. Interface to the Fire Alarm System for fire signaling override when necessary
4. Interface to any site wide master station
5. UFC 4-021-01 Compliant Mass Notification/Life Safety System
6. 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. Device Placements on Prototype drawings on bid drawings are shown as one suggested layout. Final placement of devices is by AHJ.

C. Authority Having Jurisdiction: The Authority Having Jurisdiction for this project is to be determined by the Contractor.

1.2 ALTERNATES, MASS NOTIFICATION / LIFE SAFETY

A. Strict conformance to this specification is required to ensure that the installed and programmed system will function as designed, and will accommodate the future requirements and operations of the building. All specified operational features must be met without exception.

B. The authorized representative of the manufacturer of the major equipment shall be responsible for the satisfactory installation of the complete system.

C. All equipment and components shall be the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

D. All control panel assemblies and connected field appliances shall be provided by the same system supplier, and shall be designed and tested to ensure that the system operates as specified.
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

The system shall utilize independently addressed, microprocessor-based modules to activate the strobe circuits and for use as interface to the fire alarm signaling as detailed in this specification.

E. All equipment and components shall be installed in strict compliance with the manufacturer's recommendations.

F. The equipment to be supplied will be considered only if it meets all sections of the performance specification. Any deviations of system performance outlined in this specification will only be considered when the following requirements have been met:

G. A complete description of proposed alternate system performance methods with five (5) copies of working drawings thereof for approval by the Government, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

H. The supplier shall furnish evidence that the proposed or alternate system performance is equal or superior to the system operation stated in the specification. Such evidence shall be submitted to and accepted by the Government, not less than ten (10) calendar days prior to the scheduled date for submission of bids.

I. The supplier shall submit a point-by-point statement of compliance for all sections in this specification. The statement of compliance shall consist of a list of all paragraphs within these sections. Where the proposed system complies fully with the paragraph, as written, placing the word "comply" opposite the paragraph number shall indicate such. Where the proposed system does not comply with the paragraph as written and the supplier feels the proposed system will accomplish the intent of the paragraph, a full description of the function as well as a full narrative description of how its proposal will meet its intent shall be provided. Any submission that does not include a point-by-point statement of compliance as described herein shall be disqualified. Where a full description is not provided, it shall be assumed that the proposed system does not comply.

J. The acceptability of any alternate proposed system shall be the sole decision of the Government or his authorized representative.

1.3 REFERENCES

A. Codes & Standards

1. The equipment and installation shall comply with the current provisions of the following codes and standards:

   NFPA 70 - 2014 National Electric Code®
   NFPA 72 - 2016 National Fire Alarm Code®

   UL 464 - Audible Signaling Appliances.
   UL 864 - Control Units for Fire Protective Signaling Systems.
   UL 1971 - Signaling Devices for the Hearing-Impaired.
   UL 1481 - Power Supplies for Fire Protective Signaling Systems.
   UL 1711 - Amplifiers for Fire Protective Signaling Systems.
   UL 1635 - Digital Alarm Communicator System Units

   Federal Codes and Regulations
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

UFC 4-010-01 DOD Minimum Antiterrorism Standards for Buildings
UFC 4-021-01 Design and O&M: Mass Notification Systems

Americans with Disabilities Act (ADA)

International Standards Organization (ISO)
ISO-9000
ISO-9001

Electromagnetic Compatibility Requirements

1.4 SYSTEM DESCRIPTION

A. General, Mass Notification / Life Safety: The Contractor shall furnish all labor, services and testing materials necessary to furnish and install a complete, functional Mass Notification / Life Safety (fire alarm system). The System shall comply in respects with all pertinent codes, rules, regulations and laws of the Authority, and local jurisdiction. The System shall comply in all respects with the requirements of the specifications, manufacturer's recommendations and Underwriters Laboratories Inc. (ULI) listings.

B. It is further intended that upon completion of this work, the Government be provided with:

C. Complete information and drawings describing and depicting the entire system as installed, including all information necessary for maintaining, troubleshooting, and/or expanding the system at a future date.

D. Designs of attachments to building structure shall meet the requirements of UBC, Seismic Zone, or as directed by Authority Having Jurisdiction. Submit detailed mathematical analysis of the design.

E. Complete documentation of system testing.

F. Certification that the entire system has been inspected and tested is installed entirely in accordance with the applicable codes, standards, manufacturer's recommendations and ULI listings, and is in proper working order. Contractor shall fill out the "Fire Alarm System Record of Completion" after testing the system as required by Chapter 10 of NFPA 72 - 2007 edition, and the requirements of Annex E.

G. Mass Notification System. Provide and install a new mass notification system consisting of:

1. The Autonomous Control Unit (ACU) shall be located with the central fire alarm control cabinet.

2. The combination Remote LCD annunciator with remote microphone / Local Operator Console shall be located at the main store entrance, also in security office, store manager office and as described in UFC 4-021-01.

3. Provide a combination multi-channel one-way voice communication system.

4. Booster Power Supplies, (BPS) to power the strobe lights shall be located, as needed for the number of mass notification strobes in the building. Each BPS shall provide supervision to
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

the strobe lights and associated wiring as required by UL, and any fault shall be transmitted to the mass notification main control panel.

5. Provide audible appliances located throughout the building.

6. Provide synchronized Class A wired visual appliances located throughout the building.

7. Provide interface to the fire alarm control 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 horn/strobes shall be silenced so that the mass notification message can be heard throughout.

H. Mass Notification Autonomous Control Unit.

1. The Autonomous Control Unit (ACU) shall be located adjacent to the remote fire alarm annunciator and shall be multiplexed back to the main mass notification panel and provide the capability to page any level of the building individually as well as the ability to activate any one of 7 mass notification messages stored in the ASU portion of the mass notification panel.

2. The local Operator Console /Remote LCD annunciator with remote microphone shall be located per UFC 4-021-01. All locations shall be verified with the Authority Having Jurisdiction.

3. Provide a combination multi-channel one-way voice communication system having a minimum of eight (8) prerecorded mass notification event messages as well as the ability to page a manual message from the microphone in the local operator console.

4. Provide synchronized Class A wired amber visual appliances located throughout the building.

5. Provide textual signage located throughout the building as required by UFC 4-021-01.

6. Provide a connection to receive signals from and to transmit signals to the base mass notification system.

7. Provide a connection to the building public address system.

1.5 OPERATIONS

A. Upon manual initiation of any mass notification event:

1. The selected message shall be broadcast throughout the entire building. This message shall override any fire messages in progress or subsequent to the initiation of the mass notification message. The mass notification message shall continue until overridden by a manual page or the message broadcast is manually discontinued. This message shall also be fed into the building public address system.

2. The synchronized amber alert strobes shall be activated for the duration of the message.

3. The clear “fire” strobes shall be extinguished if flashing and prohibited while the mass notification event is active.

4. The textual signage shall indicate a mass notification event is in progress.
5. The panel / ACU shall indicate all applicable information associated with the event condition including: message active destination zones if applicable.

6. The remote annunciator / LOC LCD/LED's associated with the event shall be illuminated.

7. It shall be possible to duplicate any ACU command/function from any LOC systems.

B. System Configuration:

1. All Mass Notification / Life Safety System equipment shall be arranged and programmed to provide, the notification of building occupants and to facilitate the safe evacuation of building occupants, as required.

2. Power Supply Audio: Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for seventy-two (72) hours and capable of operating the system for fifteen (15) minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

3. Display: The main display interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermix to eliminate operator confusion. A "Details" switch shall provide additional information about any device highlighted by the operator.

4. Notification Appliance Circuits: All notification appliance circuits shall be Class A (Style "Z"). All notification appliance circuits shall have a minimum circuit output rating of: 2 amps @ 24 vdc; 50 watts @ 25V audio, and 35 watts @ 70V audio. The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

5. Network Wiring:

a. The system supplied under this specification shall utilize node-to-node, direct-wired multi-priority peer-to-peer network operations. The system shall utilize independently addressed, output modules as described in this specification for triggering of the BPS units for the amber mass notification strobe lights. The peer-to-peer network shall contain multiple nodes consisting of the ACU, main controller, remote control panels, and LCD/LED (LOC) 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 communications failure between nodes.

b. When a network is wired using a Class A configuration, a single break or short on the network wiring causes the system to isolate the fault, and network communication continues uninterrupted, without any loss of function. Should multiple wiring faults occur, the network re-configures into many sub-networks and continues to respond to alarm events from every panel that can transmit and receive network messages.

1.6 SUBMITTALS
A. The contractor shall purchase no equipment for the system specified herein until the Government has approved the project submittals in their entirety and has returned them to the contractor. It is the responsibility of the contractor to meet the entire intent and functional performance detailed in these specifications. Approved submittals shall only allow the contractor to proceed with the installation and shall not be construed to mean that the contractor has satisfied the requirements of these specifications. The contractor shall submit five (5) complete sets of documentation within 30 calendar days after award of purchase order.

B. Each submittal shall include a cover letter providing a list of each variation that the submittal may have from the requirements of the contract documents. In addition the Contractor shall provide specific notation on each shop drawing, sample, catalog cut, data sheet, installation manual, etc. submitted for review and approval, of each such variation.

C. All drawings and diagrams shall include the contractor's title block, complete with drawing title, contractor's name, address, date including revisions, and preparer's and reviewer's initials.

D. Product Data: Data sheets with the printed logo or trademark of the manufacturer for all equipment. Indicated in the documentation will be the type, size, rating, style, and catalog number for all items proposed to meet the system performance detailed in this specification. The proposed equipment shall be subject to the approval of the Government and Contracting Officer.

E. Shop Drawings: A complete set of shop drawings shall be supplied. The shop drawings shall be reproduced electronically in digital format. This package shall include but not be limited to:

1. Control panel wiring and interconnection schematics.
2. Complete point-to-point wiring diagrams.
3. Riser diagrams.
4. Complete floor plan drawing locating all system devices and 1/4" = 1'-0 scale plan and elevation of all equipment in the Fire Command Station. Including showing the placement of each individual item of fire alarm, security, and access control equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
5. Detailed system operational description. Any Specification differences and deviations shall be clearly noted and marked.
6. Complete system bill of material.
7. All drawings shall be reviewed and signed off by an individual having a minimum of a NICET III certification in fire protection engineering technology, subfield of fire alarm systems.
8. Quality Assurance/Control Submittals
9. Installer's Certification
10. The engineered systems distributor must be licensed in the state of project location and have been incorporated in the business in that state for a minimum of 5 years.
11. Submit a copy of the system supplier's training certification issued by the manufacturer of the integrated life safety system, and a copy of the installing technician's NICET certification.
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

12. Complete calculations shall be provided which show the electrical load on the following system components:

13. Each system power supply, including stand-alone booster supplies.

14. Each standby power supply (batteries).

15. Each notification appliance circuit.

16. Each auxiliary control circuit that draws power from any system power supply.

F. Close Out: Five (5) copies of the following documents shall be delivered to the Contracting Officer at the time of system acceptance. The close out submittals shall include:

1. Project specific operating manuals covering the installed integrated life safety system. The manual shall contain a detailed narrative description of the system architecture, inputs, notification signaling, auxiliary functions, annunciation, sequence of operations, expansion capability, application considerations and limitations. Manufacturer's data sheets and installation manuals/instructions for all equipment supplied. A generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

2. As-Built drawings consisting of: a scaled plan of each building showing the placement of each individual item of the Integrated Life Safety System equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the Contracting Officer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

3. All drawings shall be provided in standard .DXF format. A vellum plot of each sheet shall also be provided.

4. The application program listing for the system as installed at the time of acceptance by the Contracting Officer and/or local AHJ (disk, hard copy printout, and all required passwords).

5. Provide the name, address and telephone of the authorized factory representative.

6. A filled out Record of Completion similar to NFPA 72, 2016 edition figure 4.5.2.1.

7. Include a complete set of drawings in final record building drawings.

1.7 QUALITY ASSURANCE

A. The contractor shall have successfully installed similar system fire detection, evacuation voice and visual signaling control components on a previous project of comparable size and complexity. AAFES and the Government reserve the right to reject any control components for which evidence of a successful prior installation performed by the contractor cannot be provided.

B. The contractor shall have in-house engineering and project management capability consistent with the requirements of this project. Qualified and approved representatives of the system manufacturer shall perform the detailed engineering design of central and remote control equipment. Qualified and approved representatives of the system manufacturer shall produce all panel and
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

equipment drawings and submittals, operating manuals. The contractor is responsible for retaining qualified and approved representative of those system manufacturers specified for detailed system design and documentation, coordination of system installation requirements, and final system testing and commissioning in accordance with these specifications.

1.8 WARRANTY AND MAINTENANCE

A. The Contractor shall supply the following spare parts:

1. Audible and visible devices - One (1) percent of the installed quantity of each type, but no less than two (2) devices.

2. Keys - A minimum of three (3) sets of keys shall be provided and appropriately identified.

B. Warranty:

1. The contractor shall warranty all materials, installation and workmanship for one (1) year from date of acceptance, unless otherwise specified. A copy of the manufacturer's warranty shall be provided with closeout documentation and included with the operation and installation manuals.

1.9 TRAINING

A. The System Supplier shall schedule and present a minimum of 8 hours of documented formalized instruction for the Contracting Officer, detailing the proper operation of the installed System.

B. The instruction shall be presented in an organized and professional manner by a person factory trained in the operation and maintenance of the equipment and who is also thoroughly familiar with the installation.

C. The instruction shall cover the schedule of maintenance required by NFPA 72 and any additional maintenance recommended by the system manufacturer.

D. Instruction shall be made available to the Local Municipal Fire Department if requested by the Local Authority Having Jurisdiction.

PART 2-PRODUCT

2.1 MANUFACTURER

A. All equipment and components shall be the manufacturer's most current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.

B. The contractor shall be experienced in the installation of UL listed fire alarm systems as the Mass Notification system shall be a fully supervised Class A wired voice and visual annunciation sys-
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

System to provide full coverage both audibly and visually the entire project, to meet ADA and NFPA 72 installation for voice and visual evacuation systems.

C. The manufacturer of the system equipment shall be regularly involved in the design, manufacture, and distribution of all products specified in this document. These processes shall be monitored under a quality assurance program that meets the ISO 9000 requirements.

D. All System components shall be the cataloged products of a single supplier. All products shall be listed by the manufacturer for their intended purpose.

E. All control panel assemblies and connected field appliances shall be both designed and manufactured by the same company, and shall be tested and cross-listed as to ensure that a fully functioning is designed and installed. The system supplied under this specification shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification.

2.2 PANEL COMPONENTS AND FUNCTIONS

A. Combination Mass Notification / Life Safety

1. The control panel shall be a multi-processor based networked system designed specifically for one-way emergency audio communications applications. The control panel shall be listed and approved for the application standard as listed under the General section.

2. The control panel shall include all required hardware, software and site-specific system programming to provide a complete and operational system. The control panel shall be designed such that interactions between any applications can be configured, and modified using software provided by a single supplier. The control panel operational priority shall assure that mass notification takes priority over other life safety activities coordinated by the control panel.

3. The control panel /ACU shall include the following capacities:

a. Support up to 2500 analog/addressable points.

b. Provide an operator interface control/display that shall annunciate command and control system functions.

c. Provide an internal audible signal with different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.

d. Provide system reports that provide detailed description of the status of system parameters for corrective action or for preventative maintenance programs. Reports shall be displayed by the operator interface or capable of being printed on a printer.

e. Provide an authorized operator with the ability to operate or modify system functions like system time, date, passwords, holiday dates; restart the system and clear control panel event history file.

f. Provide an authorized operator to perform test functions within the installed system.
g. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

B. Control Panel / Autonomous Control Unit:

1. The system shall be designed and equipped to receive, monitor, and annunciate signals from devices and circuits installed throughout the building. Standard LED annunciators may be combined in common enclosures provided that the groups of LED's comprising each of the required annunciators are separated from one another (MN Event Messages, Detection, Supervisory, Status, and Security) and clearly labeled.

2. Manufacturers' standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers' standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Contracting Officer is required.

3. Activation of a mass notification event, receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.

4. The annunciator shall contain the following system status indicators:
   a. 168 character Backlit Liquid Crystal Display
   b. System Normal Indicator
   c. System Common Alarm Indicator
   d. System Common Trouble Indicator
   e. System Common Supervisory Indicator
   f. System Ground Fault Indicator
   g. System Disabled Point(s) Indicator
   h. System Reset Switch with Indicator
   i. System Alarm Silence Switch with Indicator
   j. System Trouble Silence Switch with Indicator
   k. System Message Queue Scroll Switches.
   l. 10-Digit Keypad to Enable/Disable System and Functions.

5. The LED Annunciator/Switches shall provide manual initiation of mass notification event messages (8 minimum) and destination zones.

6. The LED Annunciator shall contain the following switches:
   a. Provide two-position switch to manually unlock all stairwell and exit doors.
   b. Provide switches for system by-pass functions. Actual switch function shall be determined by the Contracting Officer.
   c. Provide a one-way emergency voice communication system annunciator with the following design: This standard LED annunciator (LOC) shall incorporate the microphone for the one-way broadcasts, including all required zone select and manual override control switches to duplicate the functions of the ACU, in the event the ACU is not accessible. Marine Corps: Provide no more than one (LOC) if necessary in addition to the ACU. Locate the LOC as directed by the AHJ.
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

d. The unit shall be fully supervised from the control panel. The housing shall contain a lock that is keyed identical to the fire alarm system for the building.

e. Auxiliary Input Module shall be designed to be an outboard expansion module to either expand the number of optional remote microphone stations, or allow a telephone interface.

f. Remote microphone station (PA) shall incorporate a Push-To-Talk (PTT) microphone, and controls to allow public address paging in the facility. The public address paging function shall not override any alarm or notification functions.

7. Audio:

a. The system shall be capable of delivering multi-channel audio messages simultaneously over copper and/or fiber media. All audio messages and live pages shall originate at the one-way audio control unit. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control or to all areas of the building simultaneously. The system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits.

b. The one-way emergency audio control shall provide control switches to select and direct Mass Notification Messages.

c. Manual page controls and destination switches shall be provided.

8. Audio Amplifiers (Multi-Channel): Provide as minimum one twenty (20) watt audio amplifier per paging zone. The system software shall be capable of selecting the required audio source signal for amplification. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000 Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring. Each amplifier output shall include a dedicated, selectable 70 Vrms output. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier, and replace the function of the failed amplifier.

9. Power Supply:

a. System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.

b. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.

c. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.

d. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciated as battery trouble and identify the specific power supply affected.
e. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 60 minutes maximum.

f. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72. The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled Mass Notification System CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

2.3 FIELD MOUNTED SYSTEM COMPONENTS

A. Low Profile Speaker-Strobe:

1. Provide low profile wall mount speaker/strobes. The low profile speaker/strobe shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.

2. Strobes shall provide synchronized flash output that shall be switch selectable for output values of 15cd, 30cd, 75cd & 110cd. Wattage and candela settings shall be visible with the cover installed. When the cover is installed, no mounting hardware shall be visible. In and out screw terminals shall be provided for all wiring. The low profile speaker/strobes shall mount in a North American 4" x 2 1/8" square electrical box, without trims or extension rings.

3. All "Alert" strobes shall be ceiling mounted, provided with amber lenses.

B. Speaker-Strobe Ceiling 8":

1. Provide 8" ceiling mounted speaker/strobes. In and out screw terminals shall be provided for wiring. Speaker baffles shall be round or square, steel with white finish as required. Provide square surface mount boxes with matching white finish as required. Speakers shall provide 1/2w, 1w, 2w, and 4W power taps for use with 25V or 70V systems. At the 4-watt setting, the speaker shall provide a 94-dBA sound output a frequency of 1000 Hz, when measured in an anechoic chamber at 10 ft. Strobes shall provide synchronized flash outputs. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, and 110cd devices.

2. All "Alert" strobes shall be provided with amber lenses.

C. Speakers, Outside:

1. Provide 8" recessed weatherproof outside mounted re-entrant speaker and separate strobes at the locations shown on the drawings. Weatherproof boxes shall be provided for outdoor mounting. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 70V systems. The re-entrant speakers shall utilize a high efficiency compression driver. Cone type drivers are not acceptable. At the 15-watt setting, the speaker shall provide a 102-dBA sound output over a frequency range of 400-4000 Hz, when measured in reverberation room per UL-1480. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 75cd, & 110cd de-
vices. Provide Bogen flush mount Model FMH15T speaker with SGHD8 grill and adaptor ring. Paint grill to match building color.

2. All "Alert" strobes shall be provided with amber lenses. Provide speaker/strobes with a 757A-WBW w/p box or equal

D. Remote LED Text Display

1. An LED text display shall be provided at all public exit locations. The LED text display shall be at least two lines with a minimum of 20 characters per line. The size shall not exceed 16 inches length x 6 inches height x 3 inches deep. The text display shall as a minimum meet the following requirements: (Electrical mechanical room does not require a text sign.)

   a. Two lines of information for high priority messaging.
   b. Minimum of 20 characters per line (40 total) displayed.
   c. Text shall be no less than ½” in height and readable from 1 foot to 20 feet away.
   d. 32K character memory.
   e. RS232 or RS485 serial interface included.
   f. Display shall be wall or ceiling mounted.
   g. Mounting brackets for a convenient wall/cubicle mount.
   h. During non-emergency periods, date and time shall be displayed.
   i. All programming shall be accomplished from the mass notification network.
   j. No user programming shall be required.

E. Fiber Optic: The fiber optic transceiver shall be fully compatible with EIA standards for RS-232, RS-422 and RS485 at data rates from 0 (DC) to 2.1 mbps (200 kbps for RS-232) in the low speed mode or from 10 kbps to 10 mbps in the high-speed mode. The fiber optic transceiver shall be capable of simplex or full duplex asynchronous transmissions in both point-to-point systems and drop-and-repeat data networks. The fiber optic transceiver shall be user configurable for the protocol, speed and mode of operation required. The fiber optic transceiver shall be installed as a stand-alone or card cage unit. The fiber optic transceiver shall operate on either multi-mode or single-mode fiber optic cable. The fiber optic transceiver shall be supplied with optical connectors. Meet current Base standards. Verify fiber mode with Base.

PART 3-EXECUTION

3.1 INSTALLATION

A. The contractor shall provide all equipment, labor, materials, transportation and documentation required herein and on the drawings to install a complete and operable system to include all required testing and test documents. The installing contractor shall be UL listed as a fire alarm installer under category UUJS of the UL FIRE Protection Equipment Directory. The installation
shall be under the direct supervision of a factory trained representative of the equipment manufacturer with a minimum of four years experience in the installation of similar systems. Qualifications of the installers and supervisor shall be provided to the Contracting Officer upon request.

B. All system wiring shall be approved for mass notification use and shall be installed in metallic conduit or raceway. All conduit penetrations through walls shall be sealed with appropriate fire resistant material. Conduit runs shall follow the building contours and shall be installed parallel or perpendicular to walls and ceilings. All conduit field bends shall be made by benders specifically designed for the purpose. All junction boxes shall be sized to accommodate the number of conductors installed in accordance with the NEC. Conduit wire fill shall not exceed 40 percent. Conductors for lighting, power or Class 1 circuits shall not be installed with mass notification conductors in any conduit, raceway or cable.

C. Signaling line, notification and Class A circuits shall have supply and return conductors installed in separate conduits.

D. Provide all wiring in conduit. 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 FCP. Pig-tail 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.

E. 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 AS-BUILT DRAWINGS

A. 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 and contracting officer as part of the required documentation package.
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

3.3 CONNECTION OF NEW SYSTEM

A. The following new system connections shall be made during the last phase of construction, at the beginning of the preliminary tests. New system connections shall include:

1. Connection of new control modules to magnetically held smoke door (hold-open) devices.

2. Connection of new elevator recall smoke sensors to wiring and conduit.

3. Connection of new system transmitter to base fire reporting system.

B. Once these connections are made, system shall be left energized and new audio/visual devices deactivated. Report immediately to the Contracting Officer, coordination and field problems resulting from the connection of the above components.

3.4 FIRESTOPPING

A. Provide firestopping for holes at conduit penetrations through floor slabs, fire rated walls, partitions with fire rated doors, corridor walls, and vertical service shafts in accordance with Division 07.

3.5 PAINTING

A. Paint exposed electrical, fire alarm conduit, and surface metal raceway to match adjacent finishes in exposed areas. Paint junction boxes, conduit and surface metal raceways red in unfinished areas. Painting shall comply with Division 09.

3.6 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.
SECTION 27 51 17

 MASS NOTIFICATION SYSTEM

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).

F. 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

G. 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.

H. 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 meger tested for insulation resistance, grounds, and/or shorts.
SECTION 27 51 17

MASS NOTIFICATION SYSTEM

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.

1. 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.

2. Verify that the control unit is in the normal condition as detailed in the manufacturer’s O&M Manual.

3. 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.

4. Test the system for specified functions in accordance with the contract drawings and specifications and the manufacturer’s O&M Manual.

5. 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.

6. Determine that the system is operable under trouble conditions as specified.

7. Visually inspect wiring.

8. Test the battery charger and batteries.

9. 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.

10. Verify that red-line drawings are accurate.

11. Measure the current in circuits to ensure there is the calculated spare capacity for the circuits.

12. Measure voltage readings for circuits to ensure that voltage drop is not excessive.

13. 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.

14. Measure the voltage drop at the most remote appliance (based on wire length) on each notification appliance circuit.

15. 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.
16. Opening the circuit at not less than 10% of alarm initiating devices and notification appliances to test the wiring supervisory feature.

17. The Contractor shall demonstrate modem communications with remote sites as specified by the COR. Dial in capability shall also be demonstrated, using specified security.

18. 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.

3.7 ARMY/AIR FORCE SPECIFIC REQUIREMENTS: VERIFY INTELLIGIBILITY BY MEASUREMENT AFTER INSTALLATION

A. Ensure that a CIS score greater than 0.8 is provided in each area where building occupants normally could be found. Note: Values of 0.75 through 0.84 will be rounded to 0.8.

B. Areas of the building provided with hard wall and ceiling surfaces (such as metal or concrete) that are found to cause excessive sound reflections may be permitted to have a CIS score less than 0.8 if approved by the DOD installation, and if building occupants in these areas can determine that a voice signal is being broadcast and they must walk no more than 10 m (33 ft) to find a location with CIS score of at least 0.8.

C. Areas of the building where occupants are not expected to be normally present are permitted to have a CIS score less than 0.8 if personnel can determine that a voice signal is being broadcast and they must walk no more than 15 m (50 ft) to a location with a CIS score of at least 0.8.

D. Measurements should be taken near the head level applicable for most personnel in the space under conditions (e.g. standing, sitting, sleeping, as appropriate).

E. Commercially available test instrumentation shall be used to measure intelligibility as specified by IEC 60849 and IEC 60268-16. The mean value of at least three readings shall be used to compute the intelligibility score at each test location.

Note: An STI score of 0.7 is considered equivalent to a CIS score of 0.7.

3.8 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/mss 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.
SECTION 28 16 00
INTRUSION DETECTION

PART 1. GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Intrusion detection with multiplexed, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

1.3 DEFINITIONS

A. LCD: Liquid-crystal display.
B. LED: Light-emitting diode.
C. PIR: Passive infrared.
D. RFI: Radio-frequency interference.
E. UPS: Uninterruptible power supply.
F. Protected or Protection Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.
G. Standard Intruder: A person who weighs 100 lb or less and whose height is 60 inches or less; dressed in a long-sleeved shirt, slacks, and shoes.
H. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a “standard intruder” in a protected zone.

1.4 SUBMITTALS

A. Product Data in accordance with Section 01300 – Submittals: Components for sensing, detecting, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.
   1. Site and Floor Plans: Indicate final outlet and device locations, routing of raceways, and cables inside and outside the building.
   2. Device Address List: Coordinate with final system programming.
   3. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
   4. Details of surge-protection devices and their installation.
   5. Sensor detection patterns and adjustment ranges.
B. Equipment and System Operation Description: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer’s standard descriptions for generic systems are not acceptable.

C. Qualification Data: For Installer, testing agency.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section “Operation and Maintenance Data,” include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.
2. Central-station control-unit hardware and software data.

F. Warranty: Special warranty specified in this Section.

G. Other Information Submittals:

   1. Test Plan and Schedule: Test plan defining all tests required to ensure that system meets technical, operational, and performance specifications within 60 days of date of Contract award.
   2. Examination reports documenting inspections of substrates, areas, and conditions.
   3. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

   1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
   2. Manufacturer’s authorized representative who is trained and approved for installation of units required for this Project.

B. Intrusion Detection Systems Integrator Qualifications: An experienced intrusion detection equipment supplier and Installer who has completed systems integration work for installations similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the National Burglar & Fire Alarm Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

   1. Testing Agency’s Field Supervisor: Person currently certified as an advanced alarm technician by the National Burglar & Fire Alarm Association to supervise on-site testing specified in Part 3.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70-05, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
SECTION 28 16 00

INTRUSION DETECTION

E. FMG Compliance: FMG-approved and -labeled intrusion detection devices and equipment.

F. Comply with NFPA 70-08.

1.6 PROJECT CONDITIONS

A. Environmental Conditions: Capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Altitude: Sea level to 4000 feet.
2. Central-Station Control Unit: Rated for continuous operation in an ambient of 60 to 85 deg F and a relative humidity of 20 to 80 percent, non-condensing.
3. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, non-condensing.
4. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, non-condensing.

1.7 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of beneficial occupancy.

PART 2. PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at central-station control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or controller failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or controller.

B. System Control: Central-station control unit shall directly monitor intrusion detection devices and connecting wiring in a multiplexed distributed control system or as part of a network.

C. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

D. Operator Commands:
INTRUSION DETECTION

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.

2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.

3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.

4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.

5. Protected Zone Test: Initiate operational test of a specific protected zone.


7. Print Reports.

E. Printed Record of Events: Print a record of alarm, supervisory, and trouble events on system printer. Sort and report by protected zone, device, and function. When central-station control unit receives a signal, print a report of alarm, supervisory, or trouble condition. Report type of signal (alarm, supervisory, or trouble), protected zone description, date, and time of occurrence. Differentiate alarm signals from other indications. When system is reset, report reset event with the same information concerning device, location, date, and time. Commands shall initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.

F. Response Time: Thirty seconds maximum between actuation of any alarm and its indication at central-station control unit.

G. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from central-station control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at central-station control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

H. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

I. Alarm Transmission to Remote Monitoring Station: Transmit all alarm and supervisory indications to a designated remote monitoring station via telephone lines, dedicated alarm network. Transmissions must be compatible with monitoring station equipment. Coordinate with local authority having jurisdiction.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 16 Section “Transient Voltage Suppression.”

2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Comply with requirements in Division 16 Section “Transient Voltage Suppression” as recommended by manufacturer for type of line being protected.

B. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V RMS injected into power supply lines at 10 to 10,000 MHz.
C. Tamper Protection: Tamper switches on detection devices, controllers, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Central-station control-unit alarm display shall identify tamper alarms and indicate locations.

D. Addressable Devices: Transmitter and receivers shall communicated unique device identification and status reports to central-station control unit.

2.3 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Screw Covers: Where enclosures are accessible to unauthorized persons, secure with security fasteners of type appropriate for enclosure.

2.4 SECURE AND ACCESS DEVICES

A. Manufacturers:
   1. Advantor Network Systems 5.0 (ASN). Contact Advantor Systems Corporation – 12612 Challenger Parkway, Suite #300, Orlando, FL 32926. By phone @ 800/advantor or 407-859-3350.

B. Touchscreen, Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data. LCD type, backlit, with four lines, 20 character display. Semi-flush mount. Provide backbox. Provide 22a WG shielded, twisted pair cable for communications.

2.5 BALANCED MAGNETIC DOOR SWITCHES

A. Manufacturers:
   1. ADEMCO Group; Pittway Corporation.
   3. Amseco; Division of Kobishi America, Inc.
   4. FBI; Pittway Corporation.
   5. GE Interlogix; General Electric Company.
   7. Honeywell International Inc.
   8. Optex.

B. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral over-current device to limit current to 80 percent of switch capacity. Bias magnet and minimum of three independent form “C” Blased reed contacts shall resist compromise from introduction of foreign magnetic fields.
   1. A supervised loop with a series Magnetic Tamper and Pry Tamper are to be included.

C. Flush-Mounted Switches: Unobtrusive and flush with surface of door frame as listed in door hardware section. Provide in bid for a Sentrol 2700 series high security balance magnetic
SECTION 28 16 00

INTRUSION DETECTION

switch to replace each flush GE series with option 1840 1076W switch listed in door hardware section if base security does not allow the concealed switch listed in the door hardware section.


2.6 PIR SENSORS

A. Manufacturers:

1. ADEMCO Group; Pittway Corporation.
4. Digital Security Controls, Ltd.
5. FBI; Pittway Corporation.
6. Honeywell International Inc.
7. NAPCO Security Systems, Inc.
8. Optex.
9. Richardson Electronics, Ltd.
10. Visonic Inc.

B. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.

2. Ceiling-Mounting Unit Pattern Size: 84-inch diameter at floor level for units mounted 96 inches above floor; 18-foot diameter at floor level for units mounted 25 feet above floor.

C. Device Performance:

1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F or less, and standard-intruder movement within sensor’s detection patterns at any speed between 0.3 to 5.7 fps across 2 adjacent segments of detector’s field of view.
2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.

2.7 DURESS-ALARM SWITCHES

A. Manufacturers:

1. ADEMCO Group; Pittway Corporation.
2. GE Interlogix; General Electric Company.
3. NAPCO Security Systems, Inc.
4. Visonic Inc.
5. Husk – 20 hold up switch, or as approved by the Government.

B. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to central-station control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.

1. Minimum Switch Rating: 50,000 operations.
2. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.
SECTION 28 16 00

INTRUSION DETECTION

2.8 CAPACITANCE ALARM SWITCH

A. Manufacturers:
   1. ADEMCO.

B. Description: Switch device senses a change in electrical capacitance between the protected safe and ground caused by the proximity or contact of an intruder, sending an alarm signal to the control unit.
   1. Self-contained standby battery power source, rechargeable.
   2. Filtered and shielded against interference from RF sources or changes of temperature or humidity.
   3. Adjustable sensitivity.
   4. Insulator blocks for safe.

2.9 SECURITY SYSTEM CONTROL PANEL (SSCP)

A. Manufacturer: Advantor 5.0. Infraguard with expansion modules (IEM).

B. General Capabilities:
   1. SSCP design shall be the primary communication processor and control unit and shall be installed in a protected facility. SSCP shall interface with all optional modules and devices and provide communication with the integrated monitoring system – transmitting and displaying all security messages from the equipped facility.
   2. Standard UL enclosure (20 gauge steel).
   3. Enclosure of SSCP shall be securable with lock and key.

C. Power Requirements:
   1. Electrical input shall provided by a 120VAC, 60 Hz, using 16.5VAC, 50VA, Class 2 plug-in transformer with the option of adding surge protection.
   2. SSCP shall be equipped with a secondary power supply consisting of two 12VDC, 7AH, sealed lead-acid rechargeable batteries capable of providing power for 24 hours. Internal battery charger and integral battery supervision for AC power loss and low battery and battery trouble shall be provided.
   3. Plug-in transformer shall provide auxiliary power of 1.6 amps continuous at 12VDC.

D. Alarm Loops:
   1. Programmable, supervised, hard wired alarm loops, expandable to a total of 144 points with expansion modules and another 63 points with wireless module, shall be included in the SSCP design. See security plan for number of points required.
   2. Alarm loops shall be N/C, N/O, or both (dry contacts) and shall operate under normal ground fault conditions.
   3. SSCP design shall provide programmable alarm codes assignable to 8 separate partitions.

E. Transmission Media:
   1. Dedicated or dial transmission of signal shall be incorporated into the SSCP design.
SECTION 28 16 00

INTRUSION DETECTION

2. Dedicated transmission shall be UL Grade AA and upgradeable to DES Class A. Supervision for compromise, failure and trouble conditions shall be mandatory.

3. Dial Transmission capabilities shall include: pulse or DTMF dialing; integrated cut line supervision; RJ31X jack connection; and, include expansion for a secondary dial line and/or cellular communication capabilities.

4. The addition of optional surge protection for dedicated or dial transmission lines shall be available.

F. Arm/Disarm Function (Secure/Access)
   1. SSCP shall be capable of integrating with 16 keypads (up to 3 per partition) with an 8 partition capacity.
   2. Design of SSCP shall include programmable switch arming via momentary contact closure.
   3. Programmable arm/disarm functions shall include: single key; non-reporting; reporting; and, arm at shift.

G. Communications:
   1. Central station shall provide a 300 Baud asynchronous, full duplex secure protocol communication device capable of transmitting at 1070/1270 Hz and receiving at 2025/2225 Hz.
   2. SSCP shall provide an RS-485 port and have a communication link of 2,000 feet maximum using 22AWG, shield twisted pair cable.
   3. A maximum of forty RS-485 devices shall be supported by the SSCP. The 40 device total shall include: 16 total keypads; 8 expansion modules; 8 Smart/Audio or Listen In modules (in any combination); one wireless module; and 7 access modules.

H. General Information:
   1. SSCP shall be UL listed for the specific application.
   2. SSCP shall meet the requirements of FCC Part 15, Class B.

I. Expansion Module:
   1. Expansion module shall mount locally inside the SSCP enclosure and provide the option of remote mounting within an enclosure up to 2,000 feet from SSCP.
   2. Expansion module shall provide 16 programmable, supervised, hard wired alarm loops.
   3. Alarm loops shall be programmable alarm into any of 8 separate arming zones (protected areas).
   4. Alarm loops shall be N/C, N/O, or both (dry contacts) and shall operate normally under ground fault conditions.
   5. Four 100mA programmable hardwired auxiliary outputs shall be incorporated into the Expansion Module design.
   6. Module shall operate in an environment of 0 to 122 degrees Fahrenheit.
   7. Expansion module power shall be provided by the SSCP 12 VDC transformer and shall operate at 130mA maximum in normal standby and alarm modes.
   8. Expansion module shall be compatible with the SSCP RS-485.
   9. Expansion module shall be UL listed for the specific application.
SECTION 28 16 00
INTRUSION DETECTION

2.10 SECURITY FASTENERS

A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.

B. Manufacturers:
   1. Camcar Textron Inc.
   2. Holo-Krome; a Danaher Corporation.
   4. Tamper-Pruf Screws, Inc.

C. Drive System Types: Pinned Torx-Plus, Pinned Torx, or pinned hex (Allen).

D. Socket Flat Countersunk Head Fasteners:
   2. Stainless steel, ASTM F 879, Group 1 CW.

E. Socket Button Head Fasteners:
   2. Stainless steel, ASTM F 879, Group 1 CW.

F. Socket Head Cap Fasteners:
   2. Stainless steel, ASTM F 837, Group 1 CW.

G. Protective Coatings for Heat-Treated Alloy Steel:
   1. Zinc chromate, ASTM F 1135, Grade 3 or 4; for exterior applications and interior applications where indicated.
   2. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide, unless otherwise indicated.

PART 3. EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.
   1. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.
   2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

B. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.
SECTION 28 16 00

INTRUSSION DETECTION

1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Re-inspect after repairs or replacements are made.

2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

C. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

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

3.2 SYSTEM INSTALLATION

A. Comply with UL 681.

B. Security Fasteners: Where accessible to unauthorized persons, install intrusion detection components using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials except that a maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.

3.3 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Division 16 Section “16111 - Conduit and 16130 - Boxes.” Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be ¾ inch. Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring Method: Cable in metal raceways, concealed in accessible ceilings, walls, and floors when possible.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system’s wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

D. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer, unless otherwise indicated.

2. 120-V Power Wiring: Install according to Division Section 16141.

3. Control and Signal Transmission Conductors: Size and type cable as recommended by manufacturer.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

F. Install power supplies and other auxiliary components for detection devices at controllers, unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.
SECTION 28 16 00

INTRUSION DETECTION

G. Identify components with engraved, laminated-plastic or metal nameplate for central-station control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 16 Section 16195 “Electrical Identification.”

H. Provide dedicated 120V branch circuit for SSCP.

I. Provide telephone cable from SSCP to telephone equipment, from base communication telephone backboard.

3.4 GROUNDING

A. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding. Provide 5-ohm ground. Measure, record, and report ground resistance.

C. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements in Division 16 Section 16170.

3.5 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Manufacturer’s Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing and include with O & M data.

C. Perform the following field tests and inspections and prepare reports:

1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

2. Operational Tests: Schedule tests after pretesting has been successfully completed. Test all modes of system operation and intrusion detection at each detection device. Test for detection of intrusion and for false alarms in each protected zone. Test for false alarms by simulating activities outside indicated detection patterns.

3. Electrical Tests: Comply with NFPA 72, Section A-7. Minimum required tests are as follows:

   a. Verify the absence of unwanted voltages between circuit conductors and ground.

   b. Test all conductors for short circuits using an insulation-testing device.

   c. With each circuit pair, short circuit at the far end of circuit and measure circuit resistance with an ohmmeter. Record circuit resistance of each circuit on Record Drawings.
SECTION 28 16 00

INTRUSION DETECTION

d. Verify that each controller is in normal condition as detailed in manufacturer's operation and maintenance manual.
e. Verify that transient surge-protection devices are installed according to manufacturer's written instructions.
f. Test each initiating and indicating device for alarm operation and proper response at central-station control unit.
g. Test both primary and secondary power.

D. Report of Tests and Inspections: Prepare a written record of tests, inspections, and detailed test results in the form of a test log.

E. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

F. In the presence of representative from Provost Marshal or Security Police, test entire system for proper operation. Correct all defects.

3.6 TRAINING

A. Provide services of factory representative for four hour training seminar for AAFES Provost Marshal and Security Police personnel. Video tape training. Provide four tapes of training session.

END OF SECTION
PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 General Electrical Requirements section, and is part of each Division 26 section making reference to fire alarm systems.

B. Drawings and General Provisions of the contract, including General and Supplementary Conditions, Division 01 Specification sections and all Division 26 sections, apply to this section.

1.2 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.

1.3 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.
SECTION 28 31 11

FIRE ALARM

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.

1.4 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
NFPA 101 Life Safety 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

1.5 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 electronically in digital format in DXF format on 24"x36" vellum plots or approved equal. Submitted drawings shall have Authority Having Jurisdiction-
SECTION 28 31 11

FIRE ALARM

tion 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 manufacturer’s 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
SECTION 28 31 11

FIRE ALARM

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 1, Section ‘Operation and Maintenance Data’. 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.

1.6 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 back-board 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:
SECTION 28 31 11

FIRE ALARM

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.
SECTION 28 31 11

FIRE ALARM

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.

1.7 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 starts 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.

1.8 ACCEPTANCE TEST PROCEDURE
SECTION 28 31 11

FIRE ALARM

A. Submit for approval, prior to testing, an acceptance testing procedure meetings 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, 2016 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 initiating 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 annunciation 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 con-
SECTION 28 31 11
FIRE ALARM

trol 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. Double action shall have an alarmed lexan cover.

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
SECTION 28 31 11
FIRE ALARM

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 be-
tween 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 com-
municates 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 de-
tector 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 genera-
tion. 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 con-
troller, 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 manufacturer’s 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:
SECTION 28 31 11

FIRE ALARM

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 alphanumeric 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, which 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
SECTION 28 31 11

FIRE ALARM

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:
SECTION 283111
FIRE ALARM

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 in accordance with 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.

3.9 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.

3.10 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
SECTION 28 31 11

FIRE ALARM

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